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[Special Editorial Correspondence.]

SPRINGFIELD MEETING OF THE OHIO ASSOCIATION.

SPRINGFIELD, O., March 20th, 1895.

Dear JOURNAL: The meeting is on, and ended, so far as the first day thereof is concerned, and it was favored by a good attendance and weather which had a bad beginning but a good ending. President Cline had to do all the honors, for General Bushnell was out of the city, somewhere on the Pacific Coast, perhaps, wooing or wooed by the glorious winter breezes of that favored region. Still Mr. Cline was fully up to the duties of President and host, and what he overlooked was speedily seen to by Secretary Lathrop. Quite three score of the members were present, and these were ably reinforced by a big delegation of visitors, included amongst whom were many whose names are known by the gas men the country over. The meeting room was well fitted for the purpose it served, and Messrs. Garrett & Horton, of the Arcade, saw to it that all were taken care of, so far as creature comforts went, in excellent way. I regret to say that illness caused at one time a fear that the paper list would be considerably cut down, for three of the contributors (Messrs. Wilkiemeyer, Gwyn and Macfarlane) are prevented by sickness from attending. But it is now known that the papers by Mr. Macfarlane and Mr. Gwyn will be read by the Secretary, and also that Mr. W. W. Goodwin will give an illustrated "talk" on the matter of calcium carbide. All regret the severity of the attack of grippe which prostrated Mr. Wilkiemeyer, and if good wishes count for aught he will not be down long. The Committee having the matter of Federation in hand reported unfavorably over the idea, and were discharged, thus furnishing more evidence that the time for this departure is not at hand. Following the President's address, which had been preceded by the transaction of regular routine business, such as reports of officers of standing and special committees, roll call, the appointment of special committees—which unhappily included the naming of a Memorial Committee to suitably express the Association's feeling towards the memory of Harry Felt—came the paper reading, which was adhered to as per programme. The papers provoked good discussions, and the morning session was concluded on time. The first thing to engage the attention in the afternoon was the paper by Mr. W. S. Bowen, brought forward in place of No. 3 on the programme. Then came Mr. McIlhenny's paper on "Prepayment Gas Meters," and in right scholarly and sensible fashion he handled his subject. No. 5 would have been next, but Mr. Wilkiemeyer's inability through sickness to prepare his proposed paper on "Incandescent Burners," led to a substitution therefor of a discussion of Questions 16, 17 and 18 from the Question Box, all of which were in line of the topic which Mr. Wilkiemeyer proposed to treat. The discussion was a rarely good one, and many valuable points in connection with the merit, method of placing and working up in general of the Welsbach burner were brought out. This virtually brought us to adjournment of the first day. In the evening the members and guests were invited by the Springfield Company to visit Black's Opera House, to see the exhibition of equine wonders now going the rounds of the Buckeye State under the title of "Bartholomew's trained horses." Many availed themselves of the invitation, and afterwards it was generally agreed that while Bartholomew's horses might do for the stage, none of them would be quite a match for Henry of Navarre.

The Springfield Company bid good night to its guests by tendering them an after-theater supper at the Arcade, and I feel quite safe in saying that the speechmaking towards the close of the "snack" was of a very informal nature. A feature of an impromptu exhibition of gas appliances is a handsome specimen of Schneider & Trenkamp's reliable gas ranges, placed in full view of all in the hotel lobby, and another feature is a side-tracked travelling car, filled to overflowing with Backus heaters and other things.—C.

SPRINGFIELD, O., March 21st, 1895.

Dear JOURNAL: The weather is glorious, and the cry is still they come, for fully three-score-and-ten members of the old guard are on hand, besides the newly elected ones (a dozen or more of these have elected to march with the Association), and the guests. The business opened with the paper by Mr. C. V. Newman, entitled "Hints on Handling Gas Stoves." The way in which the author worked out this topic led to a very peppery discussion, in which the Backus "promoters" were very prominent. Is it not going a trifle too far, when things of this sort are permitted? And did the Executive Committee perform its whole duty when it passed Mr. Newman's paper for reading? The Secretary then read Mr. Gwyn's paper from manuscript, and it was favorably received, the man from Springfield having kept to his guns despite the troubles that beset him. The communication by Mr. Doherty, on "Carbide of Calcium," followed, and it was supplemented by Mr. Goodwin's paper on the same subject, which was nicely illustrated by practical experiments by the author. There can be no blinking the fact that this material and its possibilities are being closely watched by the fraternity, although it must also be admitted that at present they are more attracted to it through curiosity than by fear. Mr. Goodwin's exposition of the subject was listened to with interest and attention. The afternoon session opened with the paper on "Cannel Coal as an Enricher," by Mr. Macfarlane; and the Question Box, with its wealth of things for thought, brought the technical proceedings to a close.

The Nominating Committee reported the following list of office bearers for the ensuing year—the Association, of course, indorsing the gentlemen named:

President—Joseph Gwynn, Steubenville.
Vice-President—Jerome Penn, Washington Court House.
Secretary and Treasurer—A. P. Lathrop, Columbus.
Executive Committee—J. W. R. Cline, Springfield; W. C. Boyle, Salem; B. P. Holmes, Youngstown; Howard Jones, Circleville; G. A. Allen, Zanesville.

The next meeting place is Cincinnati, which place was especially called to the attention of the Association by a telegram from General Hickenlooper. The memorial resolutions over the late Henry Felt were eloquently expressive of the esteem in which he was held. The meeting wound up with the usual votes of thanks, a very hearty vote being passed to Mr. Goodwin for his paper on "Carbide of Calcium." The meeting was brisk, useful and entertaining.—C.

BRIEFLY TOLD.

THE AMERICAN METER COMPANY'S MEN ON STRIKE.—At 10 A.M. last Monday the workmen employed in the New York and Philadelphia shops of the American Meter Company refused to work, going out in a body. The disagreement is neither over wages nor hours of labor, and the men have absolutely no reason for their action that would be listened to for a moment by anyone who would seek to justify them. Meanwhile the Company can fill at once all orders for meters of the ordinary type, but for the present it will not receive orders for meters of the prepayment type, nor can it fill orders for repairs.

A SET OF SCHEMERS.—We, in common with others of the fraternity, had much "food for thought" in the number of applications recently made for charters for opposition gas companies in several cities of the second class in Illinois. The odd fact that the parties behind these applications were the same in each case intensified the mystery; for the schemers offered freely to supply gas at $1 per 1,000 cubic feet in places where it would not be possible to manufacture it for the figure named. Three of the cities appealed to were Rockford, Danville and Belleville, and the appealers were Phillips J. Greene, "banker," of New Orleans, La., and A. W. Ketcham, of Chicago—and elsewhere. The authorities at Danville and Rockford, suspecting the "good intent" of the parties named, hunted up their antecedents, with the result that Greene, Ketcham & Co. are likely to be prosecuted for fraudulent representation long before they are in the receipt of franchises to engage in the gas business in the places named. Ketcham's history can be obtained from the Chicago Gas Trust officers, and Greene is not worth looking up at all. The Rockford authorities have refused them a franchise point blank, and Chairman Dyson, of the Rockford Council, has in his possession enough of the history of Greene and Ketcham to keep those gentlemen out of Rockford—as free agents, that is—for some time to come.

Studies in Carbide of Calcium.

[Prepared for the JOURNAL by MR. M. P. WOOD, M.E.]

The importance of acetylene in the preparation of many chemical compounds led the chemists of the earlier part of the present century into many experiments for its production. Its value as a combining agent being independent of its value as a heat or illuminating substance, this latter feature concerns the gas engineer more than the manufacturing chemist.

Previous to the discovery by Murdock that the destructive distillation of bituminous coal produced a fixed gas that could be stored and piped to any distance, and then burned to produce light or heat, and the subsequent analysis of the gas into its now well known elements, acetylene was unknown, and it was the number of grievous accidents to life and property, from the explosion of the copper pipes used to convey Murdock's illuminating gas, that caused Sir Humphrey Davy to investigate the cause thereof. His researches led him to declare they were due to the production of acetylide of copper, by the action of illuminating gas mixed with air and moisture in the pipes, attacking the copper, forming a black, tarry deposit, which is peculiarly sensitive to percussion, and, with a moderate degree of heat, explodes with an energy greatly superior to detonating compounds of air when mixed with any of the hydrocarbon gases.

Sir Humphrey Davy produced this acetylide by passing a stream of illuminating gas through a solution of cuprous chloride. This explosive property still accompanies acetylene compounds and will be referred to again in further detail.

If we turn to the numerous text books of chemistry, we find that on the subject of carburets or carbides (compounds of carbon with metals) little is known, mainly because the subject has been but little studied. The data is very meager indeed, the subject usually being dismissed in a reference of about a half dozen lines.

In Wurtz's Dictionary of Chemistry, third edition, 1869, under the heading "Production of Acetylene," the third article gives the combinations, direct, of acetylene with carbon and hydrogen to form other hydrocarbon compounds, and also notes the remarkable feature that acetylene is the only hydrocarbon that has ever been obtained by the direct mixture and union of its elements. This union, however, is only effected by the intense heat of the electric arc, the most intense heat of the rays of the sun, concentrated by a powerful lens, being unable to effect the combination; neither does it take place under the influence of the induction spark. It furthermore states that the caloric power of the mixture is greater than the sum of the caloric power of its constituents.

Watt's Dictionary of Chemistry (English), edition of 1883, vol. 1, Addenda, pp. 1,111 (also, same work, vol. 6, first supplement, pp. 30–37), gives most of the data relative to the acetylene recorded in the earlier dictionaries of chemistry, both French and German, and brings the chemical record down to the end of the years 1869–70.

The possible future commercial relations of this gas to the gas fraternity are of importance enough to warrant free abstracts from all the available data at hand; and, so far as possible, these authorities are cited in detail, so that reference can be had to them by those interested.

Berthelot's experiments with this gas were very exhaustive. He was the first chemist to isolate it, and he gave it its name because of its relation to the radical, C_2H_2, formerly called acetyl, in the same manner as ethylene is related to ethyl. Acetylene is the name also assigned to it in the systematic nomenclature of hydrocarbons proposed by Dr. Hoffman (Proc. Roy. Soc., XV., p. 57), and indicates its relation to ethane or ethyl-hydride and ethene or ethylene.

C_2H_6.	C_2H_4.	C_2H_2.
Ethane.	Ethene.	Ethine.
(Saturated.)	(Bivalent.)	(Quadrivalent.)

Berthelot (Institute, 1859, p. 410, 1860, p. 565; Rep. Chim. II., 222; Ann. Ch. Pharm., CXV., 116) obtained acetylene by passing ethylene gas, or the vapor of ether, alcohol, aldehyde, or wood spirit, through a red hot tube, and by the action of red hot copper on chloroform. Ether yields it in the largest quantity, but by whichever of the preceding methods it is produced, it is always mixed with a considerable quantity of other gases and requires to be purified by passing the gaseous mixture into an ammoniacal solution of cuprous chloride; a red precipitate is then formed, which, when decomposed by hydrochloric acid, yields *pure* acetylene.

Berthelot has further shown that acetylene is one of the constituents of coal gas, and that it could be formed by the direct combination of carbon and hydrogen—viz., by passing hydrogen gas over charcoal

heated to whiteness by the passage of the electric arc, from a bunsen battery of 40 to 50 elements, and he thus obtained about 36 cubic inches of acetylene per hour. (Berthelot, Comp. Rendus, lv., 640.)

Odling also produced acetylene by passing marsh gas and carbonic oxide through a red hot tube. $CH_4 + CO = C_2H_2 + H_2O$.

Mathieson and Davy used a battery of 100 to 200 pairs of Wollaston's construction, 6 inches square, in their experiments to produce acetylene.

Mr. McLeod's method of producing acetylene in considerable quantities was: By burning a jet of oxygen in an atmosphere of marsh gas, and passing the products of combustion into ammoniacal cuprous chloride; if the gases are continuously supplied the operation may go on without interruption. The marsh gas may be replaced by coal gas, and the oxygen by atmospheric air without detriment to the product. (Chem. Soc. Jour. [2], iv., 152.)

Acetylene is also produced in considerable quantities by the incomplete combustion of coal gas in a bunsen lamp, when the flame accidentally burns inside the chimney. By inverting a flask over a bunsen lamp burning as above, and afterwards pouring in a solution of cuprous chloride, the sides of the flask become coated with a thick film of the red copper compound. (Riesh. Zeitscr. f. Chem. [2], iii., p. 598.)

The incomplete oxidation of organic compounds at *low* temperatures, as when it is effected in the voltaic circuit, also forms acetylene, as in the electrolysis of a solution of potassium aconite or succinate. (Berthelot, Bul. Soc. Chem. [2], ix., 103.)

Acetylene is also formed in the incomplete combustion of mixtures of hydrogen and gaseous or vaporous carbon compounds not containing hydrogen, such as cyanogen, carbon monoxide and carbon bisulphide. Such mixtures are not affected by heat, but by passing electric sparks through them acetylene is formed. (Berthelot, Bul. Soc. Chem. [2], V. 169).

By exposing marsh gas to the action of a strong heat or to the spark of a powerful induction coil, acetylene is formed. The action of the spark is very rapid at first and diminishes as the volume of free hydrogen increases; but, by absorbing the acetylene as fast as it is formed, about four-fifths of the marsh gas may be ultimately transformed into acetylene—$2CH_4 = C_2H_2 + 3H_2$. (Berthelot, Compt. Rendus, liv., 515). Coal gas may be used in this reaction instead of marsh gas, and Berthelot recommends the process in this form as the readiest means of producing acetylene. (Berthelot, Bul. Soc. Chim. [2], xi., 442.)

According to Dr. Wilde (Bul. Soc. Chim. [2], V. 267), the vapors of many organic compounds, as ethylene, alcohol, ether, acetone, amyl-alcohol, and especially benzine, yield acetylene when the induction sparks are passed through them. Amyl-hydride from American petroleum, passed through a red hot iron tube, yields 20 per cent. of acetylene. This should prove one of the cheapest and best methods for the production of acetylene. (H. Vohl, Watt's Dict. [2] iv., 302).

Acetylene is also formed by passing carbonic oxide and hydrochloric acid gas over red hot magnesium silicides. (Berthelot.)

Styrol (Cinnamene, C_8H_8) passed through a red hot tube is resolved into benzine and acetylene—$C_8H_8 = C_6H_6 + C_2H_2$. (Berthelot, Jahresb., 1866, p. 244.)

Calcium carbide, produced by the alloy of zinc and calcium formed in contact with charcoal at a very high temperature (the electric arc) is converted by water into calcium hydrate and acetylene. (Wohler, Ann. Ch. Pharm., cxxiv, 220.)

Acetylene heated with an excess of benzine is quickly absorbed, scarcely one-fifth of the original volume being left; and, on evaporating the benzine, a crystallized hydrocarbon is obtained, distinct from all known hydrocarbonss Naphthaline likewise absorbs acetylene, and more quickly than benzine. The gaseous residuum in both these reactions consists of hydrogen mixed with small quantities of ethylene and ethyl-hydride (C_2H_6.)

Iron at a dull red heat completely decomposes acetylene, but does not unite with it. (Berthelot, Bul. Soc. Chim. [2] V. 187.)

Hydrogen does not act upon ethylene (C_2H_4) at ordinary temperatures; but when the two gases are heated together small quantities of ethylene ($C_2H_4 = C_2H_2 + H_2$), benzine and other polymeres of acetylene are produced. This decomposition by heat is retarded by the presence of hydrogen and other gases—*i. e.*, nitrogen, carbon-monoxide, marsh gas, ethane or ethyl-hydride (C_2H_6), and hence it is that acetylene ***can be formed*** by the action of the electric arc on charcoal in an atmosphere of hydrogen, in spite of its tendency to split up into its elements at high temperatures. (Berthelot, Comp. Rendus, lxii., 947.)

The *Journal of Chemical Industry* (English), Vol. 12, Feb. 28, 1893, p. 178, contains a paper on "A Method for the Preparation of Acetylene," by Mr. M. W. Travers (Proc. Chem. Soc., 1893, [cxviii.] 15, 16), in which the author states:

"Wohler showed that acetylene could be produced by the action of water on calcium carbide (CaC_2), which may be prepared on a large scale as follows: 45 grms. of sodium are placed at the bottom of an iron bottle, and on top of it is poured an intimate mixture of 110 grms. of calcium chloride and 32 grms. of powdered gas carbon, well dried on an iron dish. The top of the bottle is then screwed on, and the bottle placed in a furnace and heated to a red heat for half an hour; it is then removed, cooled with water, and the contents broken out. The resultant mixture is dark gray in color, and contains 16 per cent. calcium carbide (CaC_2) mixed with an excess of carbon (added to make the mass more brittle), sodium chloride, and some cyanide. To prepare acetylene, a portion is placed in a dry distilling flask fitted with a tap, funnel and wash-bottle containing caustic soda, and hydrogen gas is passed through to eliminate any chances of explosion from small pieces of free sodium which are occasionally present; water is then run in slowly, and the acetylene is evolved in a steady stream. The bottle used consists of a 12-inch length of gas pipe welded up at one end and screwed at the other end to fit a 2 x ½-inch reducing socket, which is fitted with a 2-foot length of ½-inch pipe, serving both as neck and handle. For every gram of sodium used 250 c.c. (15.256 cu. in.) of acetylene can be obtained, which is one-half of the calculated equivalent."

Same volume, No. 12, Mar. 31, 1893, p. 288, will be found an article on "A New Process for the Preparation of Acetylene," by L. Maquenne (Compt. Rend., 1892 [cxv.,] 558–561), in which it is said:

"When a mixture of barium carbonate (witherite, $BaCo_3 = Ba''O{-}CO_2$, also found in the mineral barytocalcite, a carbonate of barium and calcium, $Ba''Ca''(Co_3)_2$, or $BaO\,CO_2 + CaO\,CO_2$, specific gravity 3.66) 26½ grms., magnesium powder 10½ grms., and charcoal 4 grms., contained in an iron bottle of 700 c.c. capacity (42.7 cu. in.), furnished with a 2 c.m. diameter and 30 c.m. long pipe neck and handle, is heated in a Parrots furnace *for 4 minutes*, the following reaction occurs: $BaCO_3 + 3Mg + C = BaC_2 + 3MgO$. The tube is then closed and rapidly cooled by sprinkling it with water. The amorphous, gray, friable product yields acetylene on treatment with water or other hydrated compounds, due to the presence of barium carbide, BaC_2. (See Comp. Rend., 114, 361.) One hundred grams. of the above-described product furnishes 5,200–5,400 c.c. of acetylene (1,440–1,490 cu. in.), containing 2 to 3 per cent. of hydrogen. By employing calcium or strontium carbonates instead of barium carbonate, the yield of acetylene *was much less.*"

This is equivalent to a yield of 3.8456 cubic feet of acetylene to a pound of barium carbide, and compares favorably with the yield of gas from the medium class of gas coals. The above processes are not patented and have been worked so long by scores of chemists that they will act as a barrier to any monopoly patents for the production of acetylene from carbide compounds. The expense of working a low heat carbide retort as described above is very small when compared with that of an electric furnace, and there appears to be no mechanical reason why such a retort should not be worked in a continuous process for the production of barium or other carbides, as is now the practice for the production of gas and coke from gas coal in the ordinary coal retort practice.

See also Muspratt's Chemistry, 4th Ed., Vol. 2, 1887, p. 259, for a description of the process of producing calcium carbide—viz., "When calcium is brought into contact with carbon under the influence of high heats, calcium carbide is formed, which, brought into contact with water, produces acetylene gas and lime hydrate."

A German patent, No. 77,168, was issued Feb. 20, 1894, to Louis Michel Bullier, of Paris, France, in which the claim is: "Process for the production of carbon compounds of the earthy alkaline metals, consisting in heating in an electric furnace a mixture of the earthy, alkaline metallic oxides—carbonates, etc., with carbon."

The "Bulletin de la Societe Chimique de Paris," gives the results of the long-continued, experimental research of M. Henri Moissan on "The Fusion and Volatilization of Metals and Metallic Oxides by Means of the Heat of the Electric Arc." These experiments have been in progress for a number of years and have embraced almost every branch of manufacturing and experimental chemistry. M. Moissan has invented a number of electrical and other furnaces to aid him in his researches, most of the adjuncts of which have been given to the world without being covered by patents.

M. Moissan has volatilized the metals—iron, tin, copper, gold, silver, platinum, aluminum, uranium and manganese, and, by the use of a condensation tube exposed in the fumes and vapors of the above metals, has condensed them back to their metallic state. The non-metals experimented with were in part: Silicon, volatilized with a current of 70

volts, 380 amperes carbon (charcoal) volatilized into graphite in 12 minutes by a current of 80 volts and 370 amperes. Oxides of lime and magnesium, that previously were regarded as infusible, were fused: Lime, with a current of 70 volts and 350 amperes, the volatilization was effected in from 8 to 12 minutes. Vapors of calcium oxide escape in plenty from the furnace, and, with a current of 80 volts and 400 amperes, the volatilization is effected in five minutes. With an 80-volt and 1,000-ampere current, 100 grammes of calcium oxide were fused and volatilized in five minutes. Magnesia proved less volatile than calcium, the boiling point being near the point of fusion, but as soon as melted, vapors were emitted. The volatilization was effected by a current of 80 volts and 300 amperes, and was very rapid with an 80 volt and 1,000 ampere current.

Moissan's conclusions are: That the most stable compounds of mineral chemistry disappear in the electric furnace, either by dissociation or by volatilization. Nothing remains to resist these temperatures except a *new series of compounds*, perfectly crystalline and of an exceptional stability. These bodies are the metallic borides, silicides and *especially carbides*.

As before stated, the text books of chemistry contain but little information on the subject of carbides, carburets, or compounds of carbon with the metals or non-metals. None of the carbides occur as natural minerals, and it has been difficult to obtain them in a definite form, and as a sequence the carbide compounds have not been much studied. The natural effect of a union of carbon with a metal is to render it hard and brittle, and the same hardening effect is noted in the union of carbon with the non-metallic group of substances.

Intimately connected with this study of carbides and carbon compounds is the hypothesis of Mendeleff, to account for the formation of petroleum, in contradiction to that of organic origin. He supposes that there are vast masses of metallic iron containing carbon within the earth, these masses resembling meteoric iron; and, in fact, they have been brought to the surface at a number of points by volcanic eruptions. The decomposition of water, the action of acids aided by the high temperature due to chemical changes, and the enormous pressures to which these substances are subjected, form hydrocarbons analogous to both the paraffine and olefine series. This hypothesis is furthermore sustained by Daubree's announcement that the carbon of all of our present organic compounds was originally existent in the form of *metallic carbides*. The electric furnace seems to reproduce the conditions of that remote geological age, and renders plausible the hypothesis.

A general method of obtaining the hydrocarbons of the $C_n H_{2n} - 2$ (acetylene) group, is to abstract two molecules of hydrobromic acid from the bromides of the olefines. As this mode of formation is quite analogous to that by which paraffines are converted into olefines, it is most probable that the acetylene hydrocarbons have a constitution similar to the olefines.

Having thus outlined the various methods of producing acetylene, it will be in order to give some data concerning its production on a commercial scale, its characteristics, etc.

Acetylene, symbol, C_2H_2; specific gravity, 902 (Berthelot) = 68.4778 pounds per 1,000 cubic feet. Ditto 910 (Thomsen) = 69.4801 pounds per 1,000 cubic feet. Combustion to CO_2, one volume of the gas unites with 2½ volumes of oxygen, forming two volumes of CO_2. When mixed with 40 per cent. of air, the specific gravity = .9412 to 946, weight = 76.57 pounds per 1,000 cubic feet. A composite gas of 30 per cent. of air and 70 per cent. of acetylene would furnish 1,000 heat units per cubic foot, or the same heat unit value as Pittsburgh natural gas.

The caloric power of pure acetylene (Thomsen's formulæ) =

21,492[7]	heat units per pound	Burning to water.
1,493[4]	" " cu. ft.	
20,745[7]	" " pound	Burning to watery vapor.
1,441[4]	" " cu. ft.	

The light is white, the non-luminous zone at the tip of the burner being very small, and two ½-foot batwing burners, burning 1½ cubic feet each per hour of pure acetylene, furnish a light approximately equal to diffused daylight.

When mixed with 40 per cent. of air, the flame is still white and tough, and not easily affected by currents of air, and cannot be extinguished by the breath without some effort. It appears to burn better, and is less liable to smoke or whistle from changes in the pressure, etc., than when burning pure. The gas is so rich in carbon, and the flame so small from the small burners used, that the surface of the flame does not afford room enough for the requisite amount of air to reach the gas to insure good combustion, a difficulty that is overcome by incorporating the air with the gas as it passes through the meter and mixer, which is actuated solely by the pressure of the gas in the small holder, and requires no clockwork or other power devices to drive it. This adulterant feature no doubt appears rather singular to the average gas manager, who has been accustomed to look upon air mixtures with his gas as a bane of worry and annoyance, where each 1 per cent. of air has been charged as the scapegoat for 6 per cent. loss in candle power, and 40 per cent. of air mixture gives no light at all. It is not to be doubted that there is a loss in candle power in the case of the acetylene mixture, but this is in a measure counterbalanced by the better combustion of the gas. However, the fact remains that a 22 to 26 candle power light is still left for use.

Water absorbs its own volume of the gas. At pressures of 42 to 45 atmospheres, and at zero temperature, acetylene is condensed into a colorless liquid, specific gravity about 0.4 (water 1), which is one of the lightest liquids known. This condensation can be made mechanically, or from the pressure obtained from the hydrating of the calcic carbide in closed retorts.

[To be Continued.]

The Best Way to Burn Gas for Lighting Purposes.

[A lecture delivered by Mr. C. R. Bellamy, of the Gas Department of Liverpool, England, at Picton Lecture Hall, Liverpool.]

Mr. Bellamy explained the reason for giving the lecture. He said that, in a recent conversation with Alderman Smith, an opinion was expressed by that gentleman that corporate officials who had special knowledge on subjects of everyday interest to the ratepayers, could largely extend their sphere of usefulness by taking advantage of the Corporation's free lectures for the purpose of laying before the public special information acquired in their respective departments. Having charge of the department of the Corporation dealing with the lighting of the city, and various other matters affecting the supervision of the general gas supply, and having had innumerable official opportunities of gauging the extent of the prevailing ignorance upon the subject of the economic use of gas, and in the belief that a few simple rules, popularly explained, as to the best methods of burning gas, might be of service to those of the ratepayers who were gas consumers, he was induced to undertake the lecture. The gas supply of Liverpool was an important matter, involving as it did the consumption of more than 300,000 tons of coal per annum, and a total gas bill of upwards of half a million sterling. He then proceeded with his lecture, the principal portions of which were as follows:

The chief use of gas being for lighting purposes, it is important that it should have a fixed illuminating value, and Parliament has provided that in Liverpool the light-giving power of the flame of an ordinary flat flame burner, consuming 5 cubic feet of gas per hour, shall be equal to the light emitted by 20 standard sperm candles. The candles, a sample of which is before you, are made specially for gas testing purposes, and, though not forming a very satisfactory standard, they give, under known conditions, a fairly constant light. Parliament has imposed upon the Corporation the duty of seeing that the gas supplied to the city is of this standard illuminating power; but, however carefully this duty may be carried out, it is of little value if the gas is ultimately consumed in such a way that barely half that lighting power is obtained.

In a report presented to the Board of Trade in 1871 by the Metropolitan Gas Referees—a body appointed, under the City of London Gas Act, 1868, to safeguard the interests of the Metropolitan gas consumers—it was stated that a large number of burners, removed from various public buildings and places of business, had been tested, and the greater portion were found to give only one-half, and some not more than one-fourth, of the light which might have been developed from the gas. If we apply this rate of waste to the gas rental of this city, the enormous loss to the community, due to ignorance of the simple laws governing gas combustion, will be apparent. Since the date of that report, great progress has been made in the manufacture of gas burners, and in perfecting the details of gas combustion. But there has not been that general recognition by the public that should have followed; and it is safe to assert that from 20 to 25 per cent. of the gas used for lighting purposes to-day is wasted—occasioning not only a monetary loss, but one of health and comfort. When it is known that one burner may develop 10 times as much light as another, with the same consumption of gas, it will be seen that the matter is of sufficient importance to warrant most careful investigation.

For the purpose of enabling you to intelligently supervise your own gas lighting, it will be necessary for me to say something about the uses of a gas meter. It is generally assumed that this instrument is of no use to anyone excepting the gas company; and since its introduction, the finger of scorn has been pointed at it as a falsifier of facts. It is

supposed to have a hopeless bias against the interests of the person using it. In the case of the gas meter, it cannot be said that familiarity has bred contempt, but rather that the instrument is condemned because it is not understood. It was invented, practically in its present form, in the early part of this century, and no amount of inventive criticism has been able to attack the principles of its construction. You may be sure that, if it were possible for anyone to demonstrate that a well made gas meter could, under ordinarily fair conditions of use, become an improper measure, I should not be defending it to-night.

It may be of interest to you to know that, under an Act of Parliament, nearly all the gas meters used in Liverpool and the district are subjected to a stringent test by the Corporation, and none can be used until certified and sealed as accurate measures. This statement will, I hope, induce sufficient confidence in the instrument to insure your attention while I describe the manner in which it can be pressed into your service—First, for the purpose of ascertaining that your fittings are sound, and nothing is being lost by leakage; secondly, to give you the fullest information as to the cost of any particular burner you may have in use, or for comparing it in point of economy with others; and thirdly, for the purpose of indicating at a glance the rate at which you are becoming indebted to the gas company.

I have here an ordinary gas meter, and I want to call your particular attention to a portion of it which I have had raised and greatly enlarged to enable you to see it. It is known as the proving wheel. It consists of a small metal drum revolving horizontally over the right-hand dial of the meter index, and is placed there principally for the purpose of enabling the person who has to test it to measure small quantities down to a single cubic foot. There is a fixed pointer, to enable you to make an accurate observation, and you will readily see how to apply it to the first purpose referred to. If the main tap supplying the gas to the meter is open and all the small taps are closed, you can, by opening one of these taps, cause the wheel to revolve until a figure is opposite the pointer, when the tap should be closed and the position of the wheel noted, after any fixed interval. It may be necessary to let matters remain in this condition for several hours to detect a slight leak; but ordinarily one hour is sufficient for practical purposes. If, at the end of this interval, the wheel has had no movement, it may be assumed that your fittings are sound; but if, on the other hand, it has indicated (say) the passage of even the tenth part of a cubic foot, it can be readily shown, by a simple multiplication sum, that you are losing gas at the rate of nearly 2,000 cubic feet per annum, and that you have a leak in your fittings worth finding and stopping, for healthful as well as monetary reasons.

With regard to its second form of usefulness, you may wish to know what a particular burner in your house is costing for gas. This information can be readily obtained, after ascertaining that your fittings are sound, by throwing all the burners out of use excepting the particular one you are anxious to test; when, by watching the revolution of the wheel, and noting the time when a particular figure is opposite the pointer, and observing how long a period is occupied in the consumption of one cubic foot, you will be able to ascertain the hourly rate of consumption, and by a simple calculation find its cost. Say, for illustration, that the wheel has indicated the passage of one cubic foot of gas in ten minutes; then the hourly rate of consumption will clearly be 6 feet, which, at the present price of gas (75 cents per 1,000 cubic feet), would indicate a cost of about two-fifths of a cent per hour. You will find, if you carry these experiments far enough, where the ordinary type of burner is used, that one burner may be costing twice or thrice as much as its fellow, or that the same burner under different pressures (with which I will deal later on) may, during a single evening, double or halve its first observed rate of consumption. This, I am sure, you will regard as a serious discovery, and it will, I hope, suggest that improper gas burners rather than gas meters are the real enemies of the gas consumer.

I will now go on to the third point of usefulness of the gas meter. It is a continuous record of the gas consumed; and if you will only take the trouble to note the weekly rate of consumption, you will often be advised in time of a wasteful use of gas. [The lecturer explained, by a diagram thrown upon the screen, the method of indicating the consumption of gas by means of the meter index.]

Now, with regard to gas burners, I want to impress upon you that the amount of light we obtain from a given quantity of gas is wholly dependent upon the form of burner we use, and the pressure under which the gas issues from it. It is impossible for the Gas Company to send gas out from the works at the most suitable pressure for use at the burner, because in Liverpool it has been forced through more than 700 miles of mains, and naturally loses a great deal of pressure by friction and varying levels, or by partially stopped pipes, etc.; and therefore gas consumers in different parts of the city have to deal with a pressure of gas liable to considerable variation, though in Liverpool this is below the average of most towns. Still, for reasons which are largely beyond control there is an extreme variation of between 0.5 inch and 3 inches. [The lecturer here explained the construction of an ordinary pressure gauge.] There is a much simpler and more homely way of measuring the pressure of any particular burner in your house. All that is required is a piece of tube with a flexible connection; nothing being better than the glass and the flexible tube of an infant's feeding bottle. The method of use is to stretch the end of the flexible tube over the gas burner, and, with a tumbler of water in one hand, take the glass tube in the other, and, after turning the gas on, immerse the tube in the water just to the point at which the gas ceases to bubble through, when the measure of the length of that part of the tube which is below the water will express in inches or parts the pressure of the gas. A simple experiment of this sort will often explain why your gas bill is much heavier than that of a friend who is known to have a similar number of burners in use for quite as many hours as your own, because you will assuredly find, in such a case, that, with ordinary gas burners, the high gas bills follow on high pressure as a natural consequence.

This brings us to the question of the effect of pressure on the gas burner; and this, generally speaking, is the most important matter we have to deal with to night. As I have already pointed out in connection with the meter experiments, you may often find that at one time the quantity of gas being used by an ordinary burner is twice, or even thrice, as much as at another time, without any apparent change. This, in effect, is equal to doubling or trebling the price of gas; and while this enormous accession is met by quarterly grumbles, followed by quarterly payments, an addition by the Gas Company of 5 or 10 per cent. to the selling price of gas is regarded as a most serious matter, and is opposed in every possible way. The reason for the different attitudes is that in one case, largely owing to your own want of care, the increase is not observed until it is too late, or is attributed to the vagaries of the meter; while on the other your attention is called to it in the daily papers, and being a matter beyond your own control, you vigorously protest against a small addition, due perhaps to a coal strike or some other extraordinary circumstance, while you remain in blissful ignorance that you generally have it in your power to reduce the cost of your own gas supply, cheaply and permanently, to the extent I have already pointed out—viz., from one-quarter to one-half.

For the purpose of bringing forcibly home to you the disastrous effect of an excessive pressure upon an ordinary gas burner, I have here an experimental gas meter, a pressure gauge with an indicating hand, and a minute clock. The meter is arranged in such a way that the hourly rate of consumption can be ascertained by the observation of one minute. I have attached to it an ordinary ungoverned No. 4 union jet burner, which is popularly supposed to consume 4 cubic feet of gas per hour. The gas supply to this burner is obtained from the small experimental gasholder on the platform, which enables us to vary the pressure of the supply at will. We will commence by testing the consumption of the burner at the lowest pressure referred to—0.5 inch—and then on by additions of 0.5 to 3 inches, when we shall find that the hourly rate of consumption varies between 3 and 10 cubic feet, as shown in the following table:

Pressure. Inches.	Consumption. Cubic Feet.	Unit Efficiency. Candles.
0.5	3.90	3.00
1.0	5.60	2.40
1.5	7.00	1.90
2.0	8.45	1.50
2.5	9.60	1.35
3.0	10.50	1.11

We will now proceed to substantiate these tests as nearly as we can in a limited experiment of this character. You will notice, in the statement of the tests, that the unit efficiency of the burner under each pressure is shown. By unit efficiency, we mean the yield of light for each foot of gas consumed. These tests were made with a photometer, and are thoroughly reliable; and you will observe that they indicate that the falling off of the unit efficiency or lighting power of the gas is almost proportional to the increased gas consumption, and that, while the gas consumption due to the higher pressure is nearly trebled, the lighting power of the burner has practically remained unchanged. [Experiment performed.]

This disastrous effect of pressure on the rate of consumption led, many years ago, to the introduction of governors for automatically adjusting the flow of gas to any desired pressure. The instruments have passed

through many changes, but they may be regarded to-day as having reached the maximum of efficiency. A governor of the best type will maintain the pressure on the burner absolutely at any desired point, through all the variations we have dealt with. There are two principal forms—viz., the main governor, for controlling a number of lights, and the single form, for governing the burner to which it is attached. The latter combination, known as the "governor burner," is both the cheapest and most efficient, and constitutes one of the most important improvements in connection with gas lighting. I will throw on the screen a table showing the tests of such a burner (a governor batswing burner, rated at 5 cubic feet per hour) under the same variations of pressure as before, and you will notice that, throughout these variations, both the consumption and unit efficiency remain stationary. We will prove the correctness of the statement as nearly as we can by experiment:

Pressure. Inches.	Consumption. Cubic Feet.	Unit Efficiency. Candles.
0.5	5.0	4.2
1.0	5.0	4.2
1.5	5.0	4.2
2.0	5.0	4.2
2.5	5.0	4.2
3.0	5.0	4.2

The enormous advantages of such a burner will, I am sure, be apparent to you all. The most prominent are, first, that it must effect a considerable economy of gas wherever it is fixed; secondly, that, given a gas of constant illuminating power, it enables you to arrange for a definite amount of light at a definite cost; and, thirdly, there is the hygienic advantage. As you are probably aware, a cubic foot of coal gas requires for its effective combustion 2 cubic feet of oxygen, which is obtained from the atmosphere, of which it forms about one-fifth part. Thus every foot of gas used vitiates or depletes 10 cubic feet of air, and therefore, if only for this reason, it is essential that governor burners should be adopted in every house. The requirements of good governor burners are: First, that they should be effective governors; secondly, the user should be able to fix them; thirdly, they should not interfere with existing fittings or involve new ones; fourthly, they should be readily adaptable to the improved form of globe; and lastly, their cost should not exceed 12 cents each.

I want to say a few words with reference to the use of globes. It is commonly supposed that, where a globe is employed, it must form a protection to the gas flame against draughts and other disturbing influences, and that therefore there is less smoke from the flame, and the gas is used to better advantage. This is true of a properly constructed globe, fixed in the right position relatively to the flame; but the old type, with a restricted opening at the bottom, causes the air to rush in with considerable violence, resulting in great unsteadiness and distortion of the flame, and an actual diminution in the yield of light. The new form, known as the "Comet" or "Moon," is of real assistance to the flame, when placed in its right position relatively to the burner, which is when the bottom of the globe and the top of the burner are in the same horizontal plane. In this position the globe exerts a steadying influence on the flame, and assists in maintaining a higher temperature about it. I have referred to the subject of globes because many of the cheaper forms of governor burners are made in such a way as to prevent their use with a globe, excepting under the improper conditions to which I have referred.

Having dealt with the governor burner which offers you the greatest relief in the readiest and cheapest way, it may be useful if I briefly refer to the higher forms of gas burners. Modern research appears to indicate that there is practically no limit to the amount of light obtainable from a given quantity of coal gas. You will recollect that the governor burner developed an amount of light equal to 4 candles from each cubic foot of gas consumed; but there are burners available to-day that will yield a light of 20 candles from the same quantity of gas. This means that, as compared even with a good governor burner, it is possible to obtain the same light with the use of one-fifth of the gas.

To take the higher class of burners in the upward order of their merit, we deal first with the Argand, which may be dismissed with the remark that its advantages with the rich gas of Liverpool do not compensate for the trouble entailed in using a chimney. In the regenerative lamp or burner, which comes next in order of merit, the flame is enclosed within a glass cover, the body of the lamp being constructed in such a way that the burning gas is utilized to heat certain tubes or chambers through which the air has to pass to support combustion. The general raising of the temperature that is effected by this means adds, in the best type of lamp, about 50 per cent. to the lighting value of the gas; and, in addition to this advantage, it lends itself readily to the purposes of ventilation.

We now come to the latest and highest type of gas burner, known as the "incandescent," in which the gas is used only as a heating medium—having first been rendered non-luminous by means of an ordinary Bunsen burner; the light being obtained by placing over the Bunsen flame a network of highly refractory material, which, being raised to a high state of incandescence by the heat, gives off a very brilliant light, having a unit efficiency of 20 candles. Examples of this new form of light are before you; and I have no doubt you have all seen it in Lime street, where its employment has reduced the annual gas charge from $3,340 to $705. It must, however, be borne in mind that the adoption of any of these higher forms of burners entails additional outlay in the matter of maintenance; and a good deal of intelligent supervision is also necessary. These considerations have caused me to deal more in detail with the advantages of the governor burner, and to put it forward for general adoption, since its first cost is inconsiderable, and its management is not more difficult than the ordinary burner in general use.

In conclusion, the lecturer directed attention to specimens of each burner referred to by him, all consuming 3 cubic feet of gas per hour; and he showed, by a diagram, the amount of light obtainable with them at the cost of 2 cents. He remarked that the great variation shown would doubtless be accepted by his audience as undeniable proof that the amount of their gas bills largely depended upon the way in which they burnt their gas.

President J. W. R. Cline's Address Before the Ohio Gas Light Association.

[Read at the 11th Annual Meeting of the Ohio Gas Light Association.]

Gentlemen and Fellow Members of the Ohio Gas Light Association—It is my unusual pleasure to cordially welcome you to the city of Springfield. It is not among my official duties, but a privilege I esteem most highly. In behalf of my fellow citizens, I extend to you the freedom of the city, and assure you that every Springfielder considers himself a committee of one, to render all possible aid towards making your visit here a pleasant and memorable one.

It is with special pride and pleasure I recall the fact that the Second Annual Meeting of your Association was held in this city, March 17 and 18, 1886. At the meeting there were 46 members present, 12 new members admitted, and 13 papers read, in addition to the able, entertaining and instructive address by the then President, Gen. A. Hickenlooper, of Cincinnati.

I hope that the members in attendance at this meeting, who were also present at the former meeting in this city, took away with them as agreeable and favorable impression as they left behind. No words of mine can add to the enduring and pleasurable remembrance in which the people of Springfield hold the Second Annual Meeting of this Association—then comparatively in its infancy.

The shadow of "hard times" still hovers over the land. Enforced economy prevails among all classes of people. Fortunately this economy inures to the benefit of the gas producer; for higher priced electric lights are displaced by the lower priced gas. Therefore the depression in business has not borne as heavily upon gas producers as upon other branches of trade. The outlook, while not bright nor assuring for business in general, is favorable to us. There has been and will continue to be during the stress of hard times an increased consumption of gas.

I would now refer to a matter which, however distasteful, is omnipresent and inevitable—like Banquo's ghost, it will not down. Of course, I mean electric lighting, our great foe in commercial illumination. The question with every wideawake, progressive gas producer is, "How can I successfully and profitably defeat electric lighting for business houses?" I am glad to be able to reiterate and reinforce the paper on the Welsbach incandescent gas burner for artificial gas, which I read at the last annual meeting of this body. A thorough test and faithful record thereof completely convinced our Company that electric lighting can be successfully displaced by the Welsbach burner. While it is true that this burner consumes less gas than the ordinary burner, it is also true that the light is so superior, and so eminently satisfactory, and so much cheaper than the electric light, that the consumer puts the Welsbach burner wherever he can use gas, and is so thoroughly pleased with his gas bills that he permanently retains the Welsbach lights and discards the electric. I can therefore consistently and confidently urge every member of this Association to introduce

and promote the use of the Welsbach light, for I am fortified with the pre-knowedge that he will be more than satisfied with the results.

I am also pleased to state that I have learned, through correspondence with the Welsbach Light Company, that experiments in street lighting with Welsbach lamps, both in this country and in England, have proven fairly successful, and in several instances have supplanted electric lighting. I look forward to the development and perfection of the Welsbach lamp for street lighting with lively interest and confident expectation.

Another question that is as constant and conspicuous as a sore thumb is, "Can a municipal corporation perform its own lighting service cheaper than a private corporation can supply it?" It has never yet been fairly and honestly demonstrated that it could, while there are numerous instances of municipal ownership of gas plants having annual deficits to be paid by taxation.

Many cities and towns have been persuaded by incomplete reports and alluring statements to undertake the experiment, but it still remains to be proven that a municipal plant can supply a cheaper light than a private company. In towns which are not large enough to make the business remunerative, the installation of a plant by the corporation may be justified, because street lighting is a public necessity; but where private plants already exist, that are able and willing to supply the municipality at a fair price, the outlay cannot be regarded otherwise than as an unnecessary expenditure and waste of public money.

Taxing or licensing of so-called gas franchises is an intermittent fad with municipal economists and reformers. This question must be met fairly and courageously on its merits. A gas franchise carries no monopoly with it, but is under burdensome restrictions and regulations of law and ordinances as an offset to, or compensation for, the privileges it bestows. There is neither justice nor equity in the proposition to impose a tax or license on gas franchises so long as they are regulated and restricted by law and ordinance as they are in Ohio.

Natural gas continues to be a formidable competitor to artificial gas for fuel purposes in many places. This competition has not been successfully solved. The hope of the artfiicial gas producer lies in the assurance of the scientist that natural gas is doomed to an early death from natural causes. In those cities and towns where there is no natural gas, the use of gas stoves should be industriously and assiduously encouraged. This can be made a large element of day consumption of artificial gas—if properly nursed and developed, as high as 50 per cent.

I heartily indorse the recommendation of ex-President Butterworth that gas manufacturers be ever enterprising in the invention and introduction of new, ornamental and convenient portable gas lamps for domestic use. The universal popularity of piano and banquet lamps is due to their beauty and adornment. We must strive to supplant these oil lamps with gas lamps even more beautiful and artistic. This seems to me to be the only means of taking advantage of the fancy "show-off" lamp fad.

A matter of profound interest is the rapid increase and almost unlimited possibilities of the use of gas engines in the arts and mechanics. This field of gas consumption is but in its infancy. It is destined to become a very important source of revenue to the gas producer. Every day adds to the popularity, capacity and desirability of the gas engine as a motive power.

Careful and accurate experiments have been made in Europe in the application of gas to street railway cars, with the following results:

1. A probably lower cost of installation than by any other means.
2. A lower cost of operating than by horses or electricity.
3. A consumption of gas per car per mile of from 25 to 35 feet.

Gas men should be and remain watchful and wideawake in the encouragement and upbuilding of this motive power branch of consumption.

As the President of your Association, I congratulate you upon the steady growth and progress of the organization. Who among us has not been benefited by our membership? I point to the printed reports of our annual meetings as a potent proof of the practical and beneficial results of our Association. Aside from this, there is the indirect but inestimable value of interchange of ideas and experiences among the members, both during the intermissions at our annual meetings and throughout the year between the meetings. It can be truly said of the founders of our organization that they built more wisely than they knew.

There is a movement on foot, with more or less following, which seeks to combine all State and National Gas Associations into one great organization or federation. My voice and influence are against such a federation. State Associations have been proved to be best for practical benefits to the members. A number of apparent and irrefutable reasons urge the maintenance of separate and distinct Associations. The conditions to be met and the interests to be served can only be accomplished through a home organization, which is at all times in hearty sympathy and full accord with the objects and purposes of its members, individually and collectively. Indisputably more can be achieved by a State or local Association.

I quote the following from an editorial in Progressive Age, of March 1st: "Certainly more can be accomplished by a State Association in the way of influencing local support to forestall legislation or other procedure inimical to the business, than all the resolutions and comfort that a body of general character can possibly hope to provide. The Ohio Society, the older of the State or sectional organizations with one exception, is a typical example of harmony and singleness of purpose that reflects the greatest possible credit upon the beneficial effect of Associations in their nature and sentiment, and its career must exert no small influence in canvassing the questions surrounding the formation of societies composed of State or sectional membership."

I desire to extend the thanks of this Association to our efficient Secretary, Mr. A. P. Lathrop, to whose industry, loyalty and enthusiastic work the success of our annual meeting is so largely due.

Expressing my appreciation of your kind attention, and asking your assistance and indulgence during the deliberations of the Association, I will close my address with the happy and sincere assurance that the cream of our programme is contained in the papers which will now be read.

Carbide of Calcium.

[Read by Mr. Henry L. Doherty, Columbus, O., at the 11th Annual Meeting of the Ohio Gas Light Association.]

For the benefit of those who have not interested themselves in the articles on this subject, that have appeared in our different gas journals, I will endeavor to present the subject in such manner as to give you as much information, in as concise a form, as the author has been able to gather.

I fully expected to have read a much more interesting paper than this may prove to be, but, failing to obtain any of the compound, I could not realize my expectations of being able to give you the results of experiments, made to determine the points having a direct bearing on the gas industry. A month or two later I might have offered a paper more worthy a place on your programme.

Calcium carbide is a compound of calcium and carbon, is a brittle, bluish-black, crystalline mass, having a specific gravity of 2.22, is chemically CaC_2, or one atom of calcium and two of carbon. It is by weight, 40 parts calcium to 24 parts carbon. The possibility of its commercial production was accidentally discovered by Mr. T. L. Willson, of the Willson Aluminum Company, Spray, N. C. A short description of its production is as follows: A mixture, in the proportions of 5 parts of burnt lime (CaO) and 3 of carbon (C), both pulverized, is subjected to the action of an electrical furnace. (A current of 4,000 to 5,000 amperes for 12 hours was used by Mr. Willson.) The conditions produced make the following chemical reactions possible: $CaO+3C=CaC_2+CO$. Probably the heat alone produces the conditions necessary for this chemical change without the assistance of the electrolytic action of the current. A word about these two chemical elements is not out of place here. Calcium is a metal, never found in its metallic form, but generally as calcium carbonate ($CaCO_3$ or ordinary limestone.) From calcium carbonate we obtain, by calcining in a lime kiln, calcic oxide, or ordinary quicklime (CaO.)

This latter compound was formerly supposed to be infusible, and its two elements hold together so tenaciously that dissociation, by heat, is next to impossible. Carbon is an element so familiar to the gas man, that all I wish to call attention to is its powerful affinity for oxygen at high temperatures. Calcium carbide has been produced at comparatively low temperatures from an alloy of calcium and the proper proportion of carbon. Probably the intense heat of an electrical furnace (estimated at 5,000° C) would not be necessary here, were it not that calcic oxide is used, and to free calcium from the atom of oxygen united with it, requires an extreme temperature much higher than that obtainable by ordinary combustion. As the heat is increased the affinity of calcium and oxygen decreases, while the affinity of the calcium and carbon increases.

Calcium carbide commands attention from the gas man chiefly for its ability to decompose water and produce acetylene gas. This property is explained by the fact that at low temperatures the calcium has a

greater affinity for oxygen than for the carbon, hence, it deserts the carbon and unites with the oxygen of the water, and forms calcic oxide. The carbon unites with the hydrogen thus set free, and forms the acetylene (C_2H_2). Metallic calcium also has the power of decomposing water, and in this action pure hydrogen gas is evolved.

Acetylene is a colorless gas, having a strong, disagreeable odor, is highly explosive, poisonous in a manner similar to carbon monoxide, has a specific gravity of .91, and the highest illuminating power of any gas known—being about 48 candles to the foot. It becomes a liquid at ordinary temperatures, at pressures, variously stated by different authorities, from 325 pounds to 1,245 pounds. It is contained in ordinary coal gas in small quantities, and believed by some to furnish the bulk of illumination obtained. Professor Lewes found that a flame of pure acetylene had a temperature of but 1,000° C., while an ordinary gas flame had a temperature of 1,360° C. Ten volumes of water absorb 11 volumes of the gas at 60° F. This furnishes us something to ponder over, in regard to excessive washing, but I may add, that as other gases contained in coal gas have a much greater affinity for water, it is highly probable that the water used in our washers first becomes charged with these, and absorbs but very little acetylene gas. When acetylene is subjected to excessive heats, it is successively converted into the following compounds: Benzol (C_6H_6), styrolene (C_8H_8), naphthaline ($C_{10}H_{10}$). This would suggest that by subjecting gas to high temperatures we would deteriorate it to the extent of converting the acetylene present to hydrocarbons of lesser value.

Calcium carbide can be produced, sold and delivered at prices estimated at from $30 to $60 per ton, and a ton will produce, in practical working, about 10,000 cubic feet of acetylene gas, having a value of 480,000-candle power hours. This would equal 120,000 cubic feet of 20-candle power gas. (By a candle power hour I mean the illuminating power of one candle burned one hour.) In other words, acetylene gas is worth, from an illuminating standpoint, 12 times as much as 20-candle power gas, and with the additional advantage of a smaller amount of heat and obnoxious products of combustion thrown off. This latter point is a great consideration, if we are to believe the electric light man. Its value as an enricher has not been fully determined, but it probably does not attain its full value as such, for coal gas, until a very high candle power is reached—50 candles or more. For water gas its value is *very low*. My meaning of the term, "full enriching value," I will explain by the following example: If a quantity of coal gas is taken, having an illuminating power of 100 candle hours, and there is added to this a quantity of acetylene, having a power of 50 candle hours, when burned alone, then, to have its full enriching value it must add 50 candle hours to the coal gas, or the total must be 150 candle hours; if less, its value as an enricher of coal gas is less than its value when burned alone.

What the gas man wants to know is, what effect will the cheap production of calcium carbide have on the gas business? Will it help or hurt? Is it another weapon placed in our hands, or has Samson's beard been slightly shorn?

Human nature looks with most favor upon the witch that paints the best fortune—I am gas man enough to appreciate this, *but being a gas man, I am necessarily honest*, hence I must give you my honest opinions and reasons therefor; here they are: We can hope for but little from this new compound in the way of an enricher, and this is the only way I can conceive of its helping us. Under some circumstances it might be used as an enricher, but as it would cost two to five times as much as naphtha, it would find a field only in cases where its ability to be used with ease and dispatch, and with the cheapest and crudest apparatus, would make it desirable. Its specific gravity must be considered in our calculations when we contemplate its use as an enricher. It is about twice as heavy as ordinary coal gas, and if added before the gas goes to the holder, stratification might take place. It might be used to better advantage by adding it to the gas at a point beyond the outlet of the holder, or as the gas is sent out. This is the only enriching field I see for it, but as "mistakes will sometimes occur in the best regulated families," we sometimes find the gas in our holders far below the quality it should be, and this compound offers us an easy and immediate remedy for our error.

On the other hand, if a perfect, automatic machine should be built in which to use it, at its present estimated price and yield, we would have a very strong competitor. At $30 per ton it appears very serious for the manufacturers of the gasoline gas machines, the Pintsch gas, and the ordinary illuminating gas. At even $100 per ton it might rob the gas man of some business. It looks very much as though, in a very short time, it would own the field for car and isolated lighting. The gasoline gas machine is the best thing now available for isolated lighting, but it only gives you a vapor varying with the change of temperature, and itself producing thermal changes, so at the burners you get a vapor-laden atmosphere, varying greatly. With acetylene you have a *gas*, not a vapor. It will never get cold enough to condense, and, being a gas, skin friction will not precipitate it. It can be used in a single lamp, or by pipes to supply an entire house. Whatever portion of it assumes the liquid form, when stored at high pressures, will immediately be converted to gas again as soon as the pressure is removed; and this is not so of other high candle power gas. When stored in the form of the carbide, a small place only will be required for enough to last an entire family a year. One writer on this subject thought that to protect it from the atmosphere airtight vessels would have to be used for shipping and storing; but probably it could be more easily and cheaply protected by dipping in some simple solution which would form a coating not soluble in water, but easily dissolved in water containing a small quantity of fuming nitric acid, or a similar mixture, not having an affinity for the carbide.

Acetylene gas for light-houses, street illumination, headlights, bicycles, carriage, piano and banquet lamps, has an unlimited field, and the carbide will undoubtedly become a staple article of trade.

That it may bring no gray hairs to the members of the gas fraternity is my sincere wish.

Changing the Arrangement of a Retort House and the Practical Results Derived Therefrom.

[Read by Mr. A. F. Nash, Windsor, Ontario, at the 11th Annual Meeting of the Ohio Gas Light Association.]

Mr. President and Gentlemen of the Ohio Gas Light Association: In the spring of 1893 we decided that the condition of the arches we had at that time in use at our Windsor works would not justify a resetting of the retorts. We replaced them with an entirely new apparatus, constructed on modern lines, and it is to give you a description of the practical difficulties we encountered in making the change and a comparison of the results as between the old benches and the new, rather than a technical paper, that I write this. Our retort house is 28 by 35 feet, and the original arrangement was 3 arches of 6 feet 6 inches inside width, with iron work for 2 benches of threes and 1 of fives, the depth of foundations only admitting of free fire furnaces. In the first place we decided that half depth regenerative furnaces would be the best for us, and as that required an excavation at least 4 feet below the foundation of our old benches, it would be necessary to rearrange the interior of the retort house and place the new stack across the end of the room, principally for the reason we could not with safety tear away the end bench and do the necessary excavating with the adjoining bench under fire and making gas, and also because we had sufficient room to put in 2 benches of sixes with arches 8 feet in width, and still have sufficient room for buckstaves and tierods between the walls of the building and the sides of the new stack.

Consequently one arch was erected at right angles to and immediately in front of the end arch of the old stack, and so close that a portion of the same was taken out to admit of the buckstaves of the new being placed. After the bench was completed we dried out the work with a slow fire, and as the heat gradually increased made preparations to change from the old stack to the new, with as little interruption in manufacturing as possible. But you will appreciate the situation when I tell you that while excavating was being done in front of the working bench in order to give sufficient room to operate the new one, the retorts were charged from a platform supported temporarily on tar barrels, and for the reason of the peculiar situation of the benches in regard to each other, that made it impossible to make gas in both at the same time. When we cut off from the old and connected with the new hydraulic, it was with the knowledge that the new bench must do the work. I wish to state I have omitted the name of the builders of the bench, partly for the reason that I do not wish to be accused of advertising any particular setting, and also because, in consequence of a careless mason leaving leaks between the primary air flues and the flues carrying away the products of combustion from the setting, the first bench erected did not work satisfactorily, and we had an experience which I trust will never happen again either to us or to the builders. I mention this to emphasize how very carefully such work should be erected. An especially satisfactory piece of work was done in erecting the second arch, when 9 inches of brickwork was removed from the side of the first bench, the buckstaves removed, the second arch built, and the whole tied together without giving a particle.

For the reason we have provided ourselves with capacity in excess of our present needs I am not in position to give the setting as satisfactory

a test as I would like, but find it quite easy to operate and am well satisfied we have done the right thing in putting in the half-depth regenerative furnace. The work in the retort house is much easier. The floor of the pit being 6½ feet below the floor, and 2½ feet below the top of the ash pan, gives plenty of head room and makes the work of cleaning the fire comparatively easy.

Another very important point is the regularity of the heats—there being very little variation. We fire with hot coke drawn from the top retort into a chute which runs it into the generator, which, of course, saves not only the handling of the coke but a great deal of heat as well. Large mouthpieces with self-sealing lids make the operation of drawing and charging much easier and the waste of gas less. Large stand pipes and extra thick front walls in the settings give almost complete immunity from stopped standpipes. Of course, I am not in a position to know as to the advantage to be derived from the longer life of the generator, as compared with the furnace of a free fire bench, but anticipate a saving in this respect also. As stated above, I am not able to give the low fuel results some managers can, but can state that as compared with the free fire benches, with the same conditions as to consumption, I do not use within 25 per cent. of the amount of fuel I did. Another advantage is the smaller amount of floor space taken up. For comparison I have noted them as follows:

Floor space of regenerative benches	247 sq. ft.
" free fire benches	304 "
Capacity of regenerative benches	108,000 cu. ft.
" free fire benches	55,000 "
" regenerative benches per sq. ft	437 "
" free fire benches per sq. ft	181 "

Let us see how the two styles of settings compare, when the difference in the yield of gas is assumed as 10,000 feet from every ton of coal carbonized, and allow the fuel results to vary according as the bench is worked to its full capacity, or but partly. Also that the retorts are of such size as will produce 9,000 feet per mouthpiece in regenerative bench, and 5,000 feet per mouthpiece in free fire.

At Full Capacity.

Regenerative benches, to produce annually 19,710,000 cubic feet, use	1,971 tons.
Free fire benches, to produce annually 19,710,000 cubic feet, use	2,190 "
Difference	219 tons.
Regenerative bench saves 75 per cent. of 78,840 bushels of coke, equal to	59,130 bushels.
Free fire bench saves 50 per cent. of 87,600 bushels of coke, equal to	43,800 "
Difference	15,330 bushels.

Producing 10,000,000 *Cubic Feet.*

Regenerative bench uses	1,000 tons coal.
Free fire bench uses	1,111 "
Difference	111 tons coal.
Regenerative bench saves two-thirds of 40,000 bushels of coke, equal to	26,667 bushels.
Free fire bench saves 40 per cent. of 44,440 bushels of coke, equal to	17,776 "
Difference	8,891 bushels.

I leave the result in tons of coal and bushels of coke, which you can figure out according to your local prices.

The new benches are 6's, the retorts are 15 inches by 26 inches by 9 feet, with generators 4 feet long and 18 inches wide at grate bars, increasing to 2 feet 6 inches in width 1 foot above same, and sloping in the usual manner at the back. They are 4 feet in depth from grate bars to arch of generator, and we generally keep between 2 and 3 feet depth of fire. The primary air travels through a flue 6 by 6 inches by 16 feet in length, which is immediately under the bottom horizontal flue which carries the waste gases to the perpendicular flue at the back of the bench, and by which the primary air is warmed, after which it passes through a flue 4½ feet in length, from which four openings admit the air to the fire immediately under the grate bars. I would suggest that settings of this character have a stopper in the above mentioned short flue, to enable coke and ashes to be removed; as my experience has been that no matter how much care is exercised, some will get into the openings and get poked back into the flue in the effort to remove it. The generator gases pass through 14 openings in the arch, and in close proximity to the same are the same number of openings for the admission of the secondary air, which having passed completely around the flue three times, carrying away the products of combustion, is very highly heated. I would again make a suggestion in regard to these openings, which is that they should be sufficiently large, and so situated as to admit of being easily cleared of scurf that will otherwise collect and stop them up. A horizontal flue on top of the stack connects to a chimney which is 40 feet high from where the flue enters it to the top, and we consequently have so much draught that we have gotten the best results with not more than 1 inch of damper, and with not more than 1 inch opening in both primary and secondary air slides, which are 3½ inches in width. We shake up the grate bars every four or six hours, and at the same time clean the ash pan if necessary, but do not put in the supplementary bars oftener than twice a week, and have no serious clinker trouble.

I trust I have been able to make these few remarks intelligible, and shall feel repaid if I have, by relating our own experience, assisted any of you in deciding as to the better course to pursue in making proposed changes.

Prepayment Gas Meters.

[Read by Mr. John D. McIlhenny, Philadelphia, Pa., at the 11th Annual Meeting of the Ohio Gas Light Association.]

This subject is a broad one in its scope, but in this paper I shall endeavor to treat principally of the advantages of these meters, and of their applicability in the United States.

It is a fact that at present only a small proportion of the population in any city consumes gas; indeed, it may be said that only the progressive, or those in fairly comfortable circumstances, use it. The majority of people, those living in small houses and who depend upon daily wages for sustenance, do not usually burn gas. To secure the members of this class, or a considerable portion of them, as consumers, would be a "consummation devoutly to be wished." In Philadelphia, for example, there are 266,000 buildings, while the number of gas consumers or meters set is but 153,000, and this same proportion will hold good elsewhere.

A gas company does not feel safe in taking the business of the average tenant, who can move his belongings in a few hours and is without responsibility, unless there be some form of security or deposit. The tenant as a rule cannot conveniently deposit a sum of money satisfactory to the gas company, and would not if he could. He also generally belongs to the unfortunately large class who have not the moral courage to save money and to pay bills in lump sums at the end of a month. There is also a class of people in every community who are, or would be, good consumers, but require careful watching and much trouble to obtain the payment of bills, and who even with a deposit sometimes leave the company in the lurch. With all such the prepayment meter would fill a long felt want.

There would be numerous advantages in obtaining these two classes of consumers. Practically very little or no additional pipe laying would be required, as the majority of such consumers reside on streets already provided with mains, or which can be reached with short lateral branches to the regular pipe system. Securing these consumers, the general business would be more concentrated, and permit more systematic arrangement and regulation, and the more gas sold per mile of main, the less would be the relative leakage account, an important consideration. Furthermore, the gas sold would surely be paid for, and the liability for the increase of the unpaid bills account would not be incurred as with the same increase of business under present conditions.

A company to-day will spend a large amount of money in laying pipes in new or suburban districts, with the return prospective rather than immediate, while the investment made in placing prepayment meters secures a prompt and certain business, which it would be practically impossible to otherwise obtain. Following the custom adopted in England, an additional charge may be made for each 1,000 feet of gas used under the prepayment plan, to cover this extra investment, and upon which a return of from 6 per cent. to 15 per cent. may thus be derived on the total outlay, and the usual profit be made in addition on the gas sold.

Any business which has a large number of customers is safer than one which deals with a very few good consumers, or where one or two consumers are large factors in the total output. Having a large number the loss of a few would make relatively less difference in the volume of business, and in times of depression a closer average in volume would be maintained, as a depression seldom affects all branches of industry. In dull times factories frequently entirely cease operation, and

hence then use no gas. The employees, however, must live, and while they are compelled to economize in every direction, they would still use some gas for both lighting and cooking purposes, and which they could obtain by the payment of 5 cents at a time.

Some establishments and institutions are allured by the electric bulb, and, though with questioned economy and service, make their own light. Large gas consumers also take advantage of economy in consumption, by the use of efficient appliances, governor burners, and by the employment of incandescent gas lights. This efficient use of gas is not objected to by gas companies, but is generally encouraged, as it is desired that the consumer shall receive the highest value of the gas. The stability of the business is thereby better assured and extra business gained. The loss, however, thus incurred must be made up in other directions, as by the extension of the uses of gas for cooking and heating purposes, and the securing of a number of small consumers who would use gas both for light and fuel.

Prepayment meters may also be found to have a value when special meters are set for cooking ranges, and domestics be thus compelled to exercise care and be economical in the use of gas, by being given enough money each day to buy what may be determined upon as an adequate amount of gas for an ordinary day's work. If these domestics can then save a little of this money they can be depended on not to waste the gas.

The general introduction of prepayment meters would also have a sanitary value in large cities, as the smoke nuisance would be to a material extent relieved. The low chimney of the one or two-story house would not discharge its volume of smoke into the small and narrow streets, contaminating the air, and depositing soot and dirt everywhere. The labor of the householder would be lessened, as there would be no coal or ashes to handle, nor the cleaning of coal oil lamps and chimneys. The danger of fire and explosion, and the smell of coal oil and smoking wicks, would be averted; meals could be quickly and probably better cooked; the man of the house would be kept in better humor, and his wife would have less work to do, less dirt to contend with, could keep her garments cleaner, and the general domestic economy would be improved.

Such may the prepayment gas meter accomplish, and in time to come this instrument may be, even more than heretofore, an important factor in the welfare of communities; but this cannot be accomplished in a day. A bright prospect has been laid before us, and it is not visionary to believe that gas will be used to a greater extent in the future than even in the past—a great benefactor to the world.

We are all more or less familiar with the success which the prepayment meter has achieved in England, where it has made rapid strides. In Liverpool alone more than 12,000 consumers are using them. Before the introduction of prepayment meters 10½ per cent. of the population were enrolled as consumers of gas, while now the percentage is 12.46 per cent. The possible percentage may be set at 20 per cent. That is, out of a total population of 614,000, there are now 76,500 meters set for consumers. This additional and constantly increasing business represents a large consumption of gas. In other places in England the same growth has taken place, from the small agricultural town to the large city of London, where operations are performed upon a colossal scale. In all the cases of which we know, the companies have been pleased with the results of the meters, and anticipate a continued introduction. Mr. George Livesey states that, in the South of London, the average consumption from the prepayment consumers may be rated at 11,500 cubic feet per year, and in Tottenham this average consumption has been stated to be 18,500 cubic feet.

Consumers using prepayment meters have been found to use more gas than similar consumers under the old system, paying their bills at the end of the month or quarter. In a comparison made between 32 consumers of the old system and 32 consumers under the prepayment plan, the house rentals being taken as a means of comparison, it was found that the latter used 63.27 per cent. more gas in the same time than did the old consumers; this probably for the reason that the expenditure was not so noticeable, being made in small payments at a time, and because such consumers were all provided with a boiling stove or a small gas range.

The small house, and the house of the average working man, is not usually fitted for gas. The landlord will not pipe it, and the tenant cannot be expected to do so; therefore, in order to secure these consumers, it has been found necessary to lay services, set the meter and pipe the house—two to four rooms usually being sufficient—plain, exposed iron pipe being employed, with iron or other cheap brackets or drop lights; also to provide and connect a hot plate, or a small gas stove, such as one with two hot plates on top, and an oven beneath. It has also been a custom with many of the companies to supply 4 or 5-foot governor burners on the lights, it being realized that unless the gas is used without waste it will not be within reach of this class, nor compete so well with oil or candles in cost.

The cost of thus completely fitting houses has varied. In Sleaford the total cost was $13.87; in Calne, $17.30; in the South of London, when setting a simple hot plate, the cost was $21.72, and more when supplying a stove. Various circumstances will affect this, such as the length of service and character of pavement, etc. Taking these figures and making due allowances, it would appear that the cost of setting a prepayment meter in this country, including all fitting of the house, etc., would vary from $15 to $30.

The labor or work required in the care of prepayment consumers is very little, if any, greater than the labor with consumers to-day. One collector making monthly rounds, which is sufficiently often, can attend to from 1,000 to 1,500 consumers, in proportion as they are scattered or concentrated, and probably no additional service would be required where small numbers of the meters are set. The clerical work would be less, as it would be unnecessary to make out or render bills, though both the cash received and the cubic feet registration must be shown on the ledger.

If an extra charge per 1,000 feet be added to the price of the gas sold, the investment and labor account may be entirely compensated for. Suppose that the average amount of gas consumed per year in the United States by this class, and who would probably use more gas than their English brethren, would be 15,000 feet (a conservative figure), an extra charge of 20 cents per 1,000 feet would yield $3, which would pay 10 per cent. on $30, which figure ought to cover the highest average total investment. The regular profit would then be made on the gas sold, and in 10 years the cost of installation would be refunded. This $30 ought to cover the entire cost of service, meter and fittings, and estimating the present cost of service and meter at $15, the additional cost would only be $15, making a return of 20 per cent., or 10 per cent. if only 10 cents per 1,000 extra be charged. It is also probable that more than 15,000 feet of gas would be consumed. Suppose that only one burner is used for light for 3 hours each day; at 5 feet an hour the consumption would amount to 450 feet per month; and that a hot plate or small stove burning 10 feet per hour is used for 5 hours a day in the preparing of meals, the consumption would equal 1,500 feet per month, making a total of 1,950 feet per month, and 23,400 feet per year. This probably would be realized, as under the prepayment plan more gas is used than under the general system, and in all cases gas would be used for cooking purposes.

This is essential, as the business would hardly be worth securing merely for the gas used for lighting purposes, and in order that gas can be used by this class for such a purpose, it must be low enough in price to be not more, or not much more expensive than the cost of other fuels, and at the same time be cheap enough to permit the exaction of an extra charge as rental, should the company adopt that system. It is likely that such would not be necessary in many cases, as the gas sold under this plan may be estimated as costing no more than the materials used in its manufacture, and hence would allow a larger margin of profit when some of the fixed charges, such as taxes, salaries, etc., are removed. If rentals, however, should be adopted in cities where meter rents are prohibited, recourse may be had then for rentals on the stove and fittings.

The whole question before us turns upon whether gas is cheap enough, and if the people of the working class would use it if the opportunity were afforded them. It may be remarked by some that the people of this country are different from those across the water, but we can pretty well depend upon it that human nature is much the same the world over. Everywhere people hate to pay bills, and particularly at the end of a month, when what they have to pay for is used and gone, and it is largely for this reason that so much objection is made to the payment of gas bills. It is very different if what is paid for is still on hand, and this feature exists under the prepayment meter plan, where the consumer can see that each nickel, or any other coin to which the meter may be adapted, gives him so much gas—a special dial and hand showing this, and this gas can be used as desired. By the expenditure of but 5 cents at a time, taking this as the coin most to be used (as 5 nickels are much less than a quarter of a dollar in the average mind), the consumer will seldom know what the total spent in a month amounts to, and the recollection of having paid a "great deal more this month than the same month last year" will not burden his memory. I have inquired of a number of people who use oil as to the cost of light per month, and few could furnish the information, even after reflection. They were also unable to tell how much coal was used for cooking purposes in the summer time, or at any other season.

From the information secured at random, the writer would gather that the better class of working men in Philadelphia spend from 50 cents to $1 per month for light when using oil, and from $2 to $3 per month for coal for cooking purposes, anthracite coal being used at $5.50 per ton. This amount of business in gas would be profitable even where the price of coal is one-half these figures.

In the winter time it would probably be found that the use of gas for cooking would not be entirely discontinued, and that the loss, if any, would be largely made up by the longer lighting hours. Gas used for light could also be made a factor in heating, during the cold weather, by the employment of a device known as "the poor man's stove," familiar to some now as used over oil lamps. It is simply a small drum of sheet iron suspended about 6 inches over the gas flame, by an arm from the bracket or by a wire from the ceiling, with the under head of the drum or cylinder open, and into which the products of combustion ascend. A small stove is the result, giving forth heat by both radiation and convection, the latter the most powerful method of heating.

It is likely that the people would use gas provided for them through prepayment meters, and the question as to the economy of the service to the householder will have to be solved by each company in its own location, where all the relative circumstances can be called into account. Without a doubt, the price of gas in a majority of the cities in the country is now low enough for the purpose.

As to the meters themselves, it may be said that they are essentially the regular make of meters, having a mechanism within or attached to them, so that by the insertion of a nickel, or other coin arranged for, and the turning of a handle or thumb key, the meter can then work or operate until a fixed amount of gas has been passed, when the supply is cut off. Two plans have been employed for such a stopment. One by placing a clog in the working parts of the meter, preventing its further operation, and one by the use of a valve which closes when the credit is exhausted. The latter has the advantage of being simple and positive. It also readily provides a warning, when the lights or flame gradually diminish, affording ample time to put another nickel in the slot before the gas goes out. In order that the householder may realize that his coin purchases the commodity, a special dial is provided, having a pointer or hand making a certain stroke upon a marked and visible scale. All meters permit the insertion of more than one coin in succession, some allowing as many as fifteen, and a quantity of gas can be bought at one time if desired, and as the gas is consumed the hand travels back to the starting point, showing at all times how much gas is unconsumed.

The meters also possess arrangements by which the price of gas may be altered *in situ*, without the necessity of removal to a shop or factory. Simple instructions for operation are placed upon the front of the meter, and upon the prepayment dial is displayed the amount of gas each coin buys. When gas is $1 per 1,000, "50 cubic feet for each 5 cent piece" is shown.

When adapted for a certain coin, the meter will only permit the use of that size of disk, and does not, if properly made, allow beating the machine or recovery of the coin. The advantage the meter possesses over slot machines in public places is that only one family has access to it, and blanks or imitation coins can be traced to the users, who are known to have obtained value for them. A check also exists in the regular cubic feet dials, some companies requiring a contract to the effect that in the case of any dispute the regular dials shall be taken as the arbiter. Little trouble has been experienced in this regard or in the breaking open of the money boxes, as it has been found that the householder having once used gas does not wish to incur the risk of having it taken away from him.

Mr. A. Dougall, the Manager of the Tunbridge Wells (England) Gas Company, having more than 1,000 prepayment meters set, states in a discussion on the subject, "that he has not had a meter returned to him, and that every one who had used one would not now like to be without it." One requisite is that all such meters must be set openly in the living apartments of the consumer's house. They will not be successful when placed in public hallways of a tenement house, where the individual responsibility is lost.

By the employment of uniformed or badged collectors under a small bond, little loss has been sustained from embezzlement, and the collectors have also the check upon them of the regular statement taker. It has been found advisable in many cases to furnish each man with a number of coin bags marked with his name, and to contain a certain amount, and also to select the collectors from the same class to which the consumers belong. Altogether, it would appear that the conditions are not unfavorable to the introduction of prepayment meters in the United States.

Those who are in the gas business know, and the public is beginning to realize, that the business is one of the most remarkable in the country. It has withstood the attacks of all competitors and has steadily gained in volume and usefulness. Its employment for cooking and heating purposes constantly increases, and the opportunity in those directions ever widens. Incandescent gas lights have proved a valuable ally to the business, and when, by the aid of prepayment meters, gas will be a necessity, used throughout every city and by the great preponderance of the population, the investor can rest still more confident that his holdings are safe and sound, and those interested in its manufacture can realize with feelings of yet greater pride that they are valuable contributors to the public welfare.

Cannel Coal as an Enricher.

[Read by Mr. Graham Macfarlane, Louisville, Ky., at the 11th Annual Meeting of the Ohio Gas Light Association.]

Having been requested by your Secretary to say something about cannel coal as an enricher for illuminating gas, it is proper to state, that not being a gas engineer, but a mining engineer and a miner and shipper of cannel coal, I shall not attempt to enlighten gas engineers on the *use* of cannel coal as an enricher, but will try to give some facts as to the location, nature and extent of the deposits and character of cannel coals available for use by American gas companies. If the list is found incomplete it will be because the mine owners did not respond to my inquiries for information.

In view of the strong competition of petroleum products, we may assume that any cannel coal which does not yield a coke, which is of some value to the gas works, is shut out from general use by gas companies, except such as are in the immediate neighborhood of the mines producing such cannel.

As to how cannel coal was deposited, various ingenious theories have been proposed. Having professionally examined nearly all of our American cannel mines, I am inclined to the belief that cannel coal was derived from a highly resinous vegetation, either distinct from that which became ordinary bituminous coal, or more likely the lighter and more resinous part of the general forest of the carboniferous age, which, in a gelatinous condition, was finally deposited either in little separate seams, or as a part of the many bituminous seams. In almost every instance the cannel coal seams are extremely sporadic and treacherous, and now, with the lower prices forced by oil competition, the lot of the cannel coal operator is surely not a happy one.

My view of the relative merits of the two enrichers, cannel and oil, is necessarily biased. It may be due to the electric light, which gives to any gas a pale and sicklied hue, but certain it is that the gas consuming public says the gas is not as good as it used to be. It may be all in the mind's eye of the consumer, but I do not believe it is. Some years ago one of the General Electric Company's most intelligent agents gave me a list of towns where they found the strongest gas competition. It may have been a coincidence, but it was true that quite 80 per cent. of these towns named were, to my knowledge, using cannel coal as an enricher.

The most famous gas cannel of our time is undoubtedly the Breckenridge. In view of the fact that the deposit is believed to be practically exhausted, we competitors very generously concede it the first place. This coal is found on the extreme eastern boundary of the western coal field of Kentucky, in Hancock county. It was vigorously worked before the war, both for shipment by river to New Orleans, and also for the manufacture of illuminating oil. About the time a successful lamp had been evolved, and the consumers educated to the use of the oil, rock oil was discovered, and cannel coal oil soon became a thing of the past. The cream of the deposit had been worked out, but the property changed hands, the mines were full of water, and finally the new owners succeeded in selling the property to some of our English cousins, who issued bonds to the amount of $400,000, and stock to the amount of $2,000,000, which they in turn unloaded on their English cousins, sisters and aunts, as appears by the stock list, where "spinster" and "widow" appear quite too frequently. The basin originally did not much exceed 100 acres, varying from zero up to three feet, but the *horizon* of the coal underlaid a broad stretch of country. The proposed purchasers sent their own expert engineer from England, who, entirely ignorant of the geology of the country or conditions of deposit, after three or four days of examining, under the influence of a charming hospitality, accompanied by a generous supply of *vin du pays* (old Bourbon), cabled back a favorable report and the deal was closed.

When the water was taken out and the true inwardness of the mine laid bare, it was quite evident that unless additional fields could be found it would be a short-lived operation, and so far as I know they

have not been found. The Breckenridge coal was under a great disadvantage, too, from the absence of railway facilities, and its long distance to tidewater, and high freight rates. In this regard the most favorably situated is the Cannelton mine, of West Virginia, which can reach tidewater possibly a dollar cheaper than the Kentucky mines. The original deposit of cannel, at Cannelton, was first opened and worked for oil distilleries, and with the completion of the Chesapeake and Ohio Railway, in 1873, began a most successful career, with, for several years, almost a monopoly of the American cannel trade. The original deposit is now exhausted, but in the vicinity of the old mine the company has opened a new one, the coal from which is said to be practically the same. Most of the coal goes east, but some of the gas companies in Ohio use it and speak very well of it. A new cannel, the Falling Rock, of West Virginia, will be in the market this year.

Coming west, we have the mines at Whitehouse, Johnson county, Ky., on the Big Sandy river and on a branch of the Chesapeake and Ohio Railway. This cannel runs from 24 inches to 30 inches in thickness, with a small seam of bituminous coal on top. The mines have been worked since 1888 and are quite successful. The cannel which is marketed under the names "Whitehouse," "Birdseye" and "Chattaroi" is well thought of by gas engineers, and is moreover an excellent domestic fuel for open fireplaces.

In Carter county, just west of here, are the Kentucky Cannel Company mines and the mines of the Lexington Mining Company. Here the cannel is thin, running from 8 inches to 20 inches, with about as much bituminous, but the expense of mining it is to some extent offset by the high quality of the cannel as a gas enricher.

The Bear Creek colliery, of the Log Mountain Coal Company, is another Kentucky cannel mine now working. This deposit, which is a remarkably thick one, averaging 4 feet, going, under the influence of the neighboring upthrow of Pine Mountain, down a dip of 8 per cent., has now been penetrated to a distance of 1,000 feet and still holds its own. The coal has in a short time established a good reputation as an enricher, and according to the testimony of gas companies using it, produces a remarkably good coke.

Near Pineville is another mine, producing the Pineville Boghead, the output of which is sent to South American gas companies. It runs about 20 inches cannel and 4 feet bituminous, the latter being sold for steam. As this cannel stands transportation to tide and thence to Brazil, it would appear to be a good grade of cannel. The Jellico cannel is mined just south of the Tennessee line.

In Ohio and Indiana are several mines—the Cannelburg, Camp Creek, the Butts and the Pinkney. Judging from the analyses published in the geological reports, Ohio cannels run pretty high in ash, but the Pinkney Cannel Company send me an analysis of their coal which, if from an average sample, would indicate a high grade of cannel. My impression is that the output of Indiana and Ohio cannel is mainly sold for domestic purposes.

I have not inserted analyses and gas tests, because chemical analysis is only an approximate guide, and gas tests are made under so many different conditions that comparisons are difficult. Those generally published are laboratory tests made under conditions which do not exist in gas works; but of course others are made to get at such actual yields as can be gotten in gas works.

I do not know that I have told you much that you did not know before, but I have been hampered by the fact that, as a member of the firm of Macfarlane & Co., of Louisville, Ky., I am in the business of selling the material which is the subject of this paper, and I have sought to avoid discrimination against my business competitors, which has kept out of this paper many facts bearing on the value of the various cannels which have been gathered by examination of the mines and selling coal.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. FRED. W. FREESE, Supt. of the La Porte (Ind.) Gas and Coke Company, has been granted a franchise by the authorities of Albion, Mich., for the establishment and operation of a gas works at that place. The franchise is to run for 25 years, and its terms in the main are favorable to the projectors. Construction work will be begun at once and hastened to completion. We understand that Mr. Simon C. Freese is also concerned in the enterprise.

THE city of Albion, in which the Messrs. Freese are to construct the works above noted, is in Calhoun county, Mich., at a point on the Kalamazoo river 20 miles west of Jackson and 96 miles west of Detroit. The Lansing Division of the Lake Shore and Michigan Central Railroad crosses the Michigan Central Railroad at Albion. It is noted for its manufactures of sashes and blinds, agricultural implements, flour, etc. It is the center of a good farming and forest district, and it also is the home of Albion College, a Methodist institution founded 35 years ago. Its resident population is about 5,000, and looks a likely field for a gas company.

AT a meeting of the Citizens Gas and Electric Company, of Jacksonville, Fla., the following officers were elected: President, S. B. Hubbard; Secretary, L. Z. Baya. Mentioning this election recalls the fact that early this month the proprietors of the Company issued the following notice: "We beg to inform our customers and the public that on and after March 1 the price of gas will be reduced to $2 per 1,000 cubic feet, net, if paid for by the 10th of the month following that in which the gas was used. The appreciable increase in consumption, incidental to the use of gas stoves and other sources, warrants us in making this reduction, which we trust will result in a larger list of consumers, and also in an increase of consumption by our present consumers. In future all bills will be rendered at $2.50 per 1,000 cubic feet, off of which a discount of 20 per cent. will be allowed, if paid on or before the 10th of each month."

THE capital stock of the Waco (Texas) Gas Company has been increased to $200,000.

THE Selectmen of West Springfield, Mass., have assented to the petition of the Springfield Gas Company to be permitted to transact business in that borough. The conditions limiting the grant are as follows: *First*—That the Company shall, before doing any work in the streets, execute under seal of agreement a bond of indemnity to secure the town against loss, cost or damage which may arise out of any act of said Company or its servants in the construction or maintenance of its plant. *Second*—That the price of gas furnished shall be as low as the price at which said Company furnishes its gas in Springfield. *Third*—That the Company shall have laid at least two miles of mains within one year from the date of the franchise. *Fourth*—That the Company shall, in the employment of labor in town, give the preference to its residents.

THE firm of Messrs. Potter & Kellogg, acting as attorneys for the Glens Falls (N. Y.) Gas Light Company, recently served notice of a suit to be brought against the local authorities to recover $2,812, alleged to have been sustained by the Company through the construction of a new sewer system in the village.

MR. W. S. RATHELL, of Cairo, Ills., writing to the JOURNAL under date of March 14th from Murphysboro, Ills., says: "I have been retained as consulting engineer by the Murphysboro Water Works, Electric and Gas Light Company, and will construct a modern water gas plant within the next two months. This is the original lighting Company of Murphysboro, and not the little affair known as the Murphysboro Gas Company. I will also retain my position with the Cairo City Gas Company."

THE Berlin Iron Bridge Company, of East Berlin, Conn., has lately completed, for the town of Barrington, R. I., an iron bridge 350 feet long and 20 feet wide.

ADVICES from Cleveland, Ohio, are to the effect that the proprietors of the Ohio Gas Company, of Lima, Ohio, as lessees of of the Ashtabula (O.) Gas Light Company, have notified the latter that they would vacate their lease on or before April 1st, according to conditions of the lease privileging them to do so at the expiration of the first year, providing the business was not satisfactorily remunerative, the lessees to forfeit all improvements made by them. The works are in no sense likely to be closed.

AT a special meeting of the Southbridge (Mass.) Gas and Electric Company Mr. Albert Wells Clark was elected President, vice Mr. E. P. Wells, resigned.

THE explosion that happened early this month in the engine room of the Quincy (Ills.) Gas Light and Coke Company caused damages amounting to less than $1,000. The press despatches announcing the occurrence greatly overstated the real loss.

AN amendment to the charter of the Fairfield (Conn.) Gas and Electric Company, by which the time for constructing the plant is to be extended to Dec. 1, 1896, has been asked for by the incorporators.

"OBSERVER," writing under date of the 15th inst., says: "I suppose you know that Mr. C. P. Greenough, who has acted as counsel for the Boston Gas Company since 1869—between 1869 and 1879 he was associated with Mr. R. M. Morse in the position—has resigned. This action of his, no matter what anyone says to the contrary, is to be applauded, for no man who values himself can afford longer to be mixed up in the maze that enmeshes the financial management of the Boston and the many Bay State Companies. However, Mr. Greenough comes out of it all unsmirched."

THE Oberlin (O.) Gas and Electric Company proposes to make some main extensions this spring.

THE following is a synopsis of New Jersey House Bill No. 465, introduced by Mr. Drake: "Provides the Governor shall appoint, with the advice and consent of the Senate, four Gas Commissioners, whose terms shall commence the first Monday in May—one Commissioner for one, another for two, another for three, and another for four years; those appointed subsequently to have a four years' term. No Commissioners shall be in any way interested in the manufacture and sale of gas. Salary to be $2,000 per annum; and they may appoint a Secretary and pay him a salary of $1,500 per annum. Every Gas Company must make a detailed report to the Commissioners each year, and the board shall have general supervision of all gas corporations. Upon complaint in writing to the board by the Mayor of any city, or 25 customers of any Gas Company, either of the quality or the price of the gas sold, such Company shall be notified, and, upon not less than five days' notice, give a public hearing upon the complaints, and may, if they deem it proper or just, order a reduction in price or improvement in quality of the gas. The Court of Chancery to be appealed to in order that the decrees of the board may be enforced."

THE proprietors of the Pittston (Pa.) Gas Company have ordered a reduction in the gas to $1.50 per 1,000 cubic feet, from $2, the concession to date from April 1st. The Company has also taken permanent office quarters in the Miners Bank building, where consumers may settle their bills, make complaints, inspect a line of gas stoves, etc. The practice heretofore has been to cause the Superintendent to act as a travelling collector.

FRANCIS A. MERRITT, the proprietor of the Hotel Congress, Detroit, Mich., was recently arrested, charged with tampering with a meter on his premises, the property of the Detroit Gas Company. The Detroit *Tribune* says that the particular plan followed was to reverse the placing of the outlet and inlet pipes.

APPLICATION for a charter for the McKeesport (Pa.) Illuminating Gas Company has been filed, and the thing looks to be a strike; for the present McKeesport Gas Company's average selling rate is $1 per 1,000 cubic feet, a 20-candle power gas being supplied. It is a well managed concern, too; so there is little prospect ahead for the strikers.

A CORRESPONDENT at Winona, Minn., forwards the following, under date of the 12th inst.: "The Winona Gas Company has determined upon several improvements to be made this year, the most notable of which is the tearing down of the present purifying building, which is 20 feet by 40 feet, and the replacing thereof by a building 25 feet by 60 feet, and two stories in height. The building is to be equipped with modern purifying machinery, and the expense of the construction is put at $8,000. The Company's business is extending rapidly."

THE first section of what is known in Missouri as the Julian bill, which was passed by the Missouri Senate some days ago, is as follows: "The public authorities of every county, city, village or other municipal or public corporation to whom application may be made by any private company, copartnership, corporation, individual or individuals, for consent to the construction, extension, maintenance, occupation or use of any electrical lighting plant or plants for the generation, transmission, sale or use of electricity, gas lighting plant, street railway or railroad, for the transportation of either freight, passengers or mails, telephone or telegraph plant, or plant for supplying water above, across, along, beneath or through any highway, road, avenue, alley, park, square, street or other public lands, must provide, as a condition precedent to the granting of such consent, that the franchise, privilege and right of such occupation, and use of any such public places for any such private purposes, shall be sold at public auction to the responsible bidder who will give the largest percentage yearly of the gross receipts derived from such occupation and use, with adequate security, as hereafter provided, for the payment thereof and for the prompt construction and completion of the proposed plant; provided that such payment shall in no case be less than 2 per cent. of the gross earnings during the first five years of such occupation and use, and thereafter, for each period of five years, such percentage shall be increased to correspond with the increase in value of the land thus occupied and used."

A BILL in the Illinois Legislature, introduced by Mr. Miller, of Cook county, provides that the Councilmen of the cities, the Trustees of towns, or other properly constituted authority of cities, towns and villages of Illinois, shall grant no franchise for the laying of gas pipes or the stringing of wires, without the consent of the owners of more than one-half of the property fronting on the street or alley along which it is proposed to lay the pipes or string the wires.

WE understand that Messrs. William A. Coombs and J. H. Buggie have purchased a controlling interest in the Coldwater (Mich.) Gas Company, and that a complete reorganization of its affairs will be made.

THE Fremont (Neb.) Gas and Electric Light Company is opposing in the courts a proposed scheme of the city to build and operate a lighting plant for municipal account, which project has been advanced to the point of advertising for proposals for bonds to meet the necessary expenditure. The Company petitioned the district court to issue an injunction in restraint of the proposed work, but we have not been advised of the decision rendered by Judge Sullivan, before whom the petition was argued.

MR. GLEN is advocating a bill in the New York Legislature, which provides that Gas Companies in this State shall not require any deposit or charge for "the use of meters," and shall be obliged to give 30 days' notice before discontinuing a supply of gas.

IT is reported that the gas and electric lighting interests of Palmyra, N. Y., are to be consolidated.

THE latest in the gas financing line is from Pittsburgh, Pa., where the signs of the times point to a deal for the consolidation and recapitalization of the illuminating gas properties of that citp. It may be said, however, that Mr. D. H. Hostetter, the President of the old Pittsburgh Gas Company, is opposed to the scheme, preferring to go on as before; and if he persists, the financiers will have a hard time of it in accomplishing their ends, for he undoubtedly holds the key to the situation.

THE Wright Gas Company is the corporate title of the concern which proposes to construct and operate a gas works for the village of Lorain, Ohio. It is capitalized in $100,000, and the prime mover is Mr. J. B. Hoge.

THE Chicago *Tribune*, in referring to the new issue of bonds by the Peoples Gas Light and Coke Company, says: "The Company has now issued bonds up to the full amount authorized by the consolidated mortgage except $2,000,000 held in the treasury specifically for extensions and betterments. An issue of $1,950,000 of the consolidated bonds has just been made and listed on the New York Stock Exchange. These bonds are secured by a mortgage dated April 1, 1893. They mature April 1, 1943. The Company issued $2,100,000 first mortgage bonds, which were listed in December, 1888, and $2,500,000 second mortgage bonds. When the consolidated mortgage was made it authorized a total issue of $10,000,000. The mortgage provided that $4,600,000 of the bonds should be retained by the trustees to retire the outstanding $2,100,000 first mortgage bonds and $2,500,000 second mortgage bonds. It was also provided that $3,400,000 might be issued for the purpose of redeeming scrip which has been declared as a dividend, and also for the purpose of increasing the plant and facilities of the Company and for discharging its floating indebtedness. The remaining $2,000,000, the mortgage provides, can only be issued against future expenditures made for improvements and betterments (to the amount of 90 per cent. thereof) in accordance with the terms of the trust deed. There was issued and listed, November 22, 1893, $1,000,000 of the bonds. An additional $450,000 was issued in February, 1894, and listed on the Stock Exchange, and the issue of $1,950,000 which has now been made completes the total of $3,400,000 which could be issued for extensions, floating debt, etc. There are $4,600,000 in the treasury held to retire the first and second mortgage bonds, and the $2,000,000 for future extensions completes the total authorized amount of $10,000,000. It will be seen, therefore, that no more bonds can be issued under the mortgage except against expenditures for extensions, and then at the rate of 90 per cent. of the expenditures. The People's Gas Light and Coke Company earned net, in 1892, $953,803. It has increased its funded debt since that time $3,400,000, but the earnings in 1894 were considerably less than in 1892, the total being $923,075. The earnings are still far in excess of the interest requirement, however, the demands for interest being $480,000."

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Mar. 9, 1895.

The Weather.—Poisoning by Coal Gas.—Explosions in Connection with Electricity Distribution.—The Corporation Gas Engineer.

The cold weather, to which I alluded last month, continued without intermission to the end of February, and constituted a season of unusual severity. Although this caused much inconvenience and trouble at the time, I do not learn that any serious accident has resulted. So far we are fortunate, for in all our gas works the whole arrangements are based on the assumption that exposures to temperatures below 32° F. are not only brief but uncommon. No permanent provision is made for thawing ice or otherwise neutralizing the effects of frost. So anything like

eight weeks of frost, with temperatures in the neighborhood of zero, is a condition that we are totally unprepared for. We usually measure the distance to which frost penetrates below the ground in inches, and are surprised if it reaches one foot. But in the recent frost it was frequently found to have attained a depth of from 2 feet to 2 feet 6 inches. As the usual rule in England is to lay gas pipes a clear 18 inches, and water pipes 2 feet below the surface, I need not enlarge on the consequences. The water companies, in particular, have suffered heavily, as not only the services but the mains themselves have been frozen, and whole districts have been left without water. In some cases long lengths of gas mains have actually been shifted out of level. However, milder weather has now set in, and we are all busy looking over our damaged plumes.

The remarks recently made by Dr. Amory at the meeting of the New England Association of Gas Engineers, on the proper means to be adopted for the restoration of persons overcome by the inhalation of illuminating or fuel gas, are both important and interesting, and it may be worth while to add a few details as to the usual custom in England. I feel more deeply on this point than some, because the health of an intimate friend was permanently injured by improper treatment, or, rather, by neglect of proper treatment, when poisoned by breathing coal gas. And some years ago a respectable young gasfitter, known to me by repute, was apprehended in the streets of London by the police, because he was staggering along in a stupid and apparently drunken condition, taken to the lock-up, placed in a cell, and left all night to sleep off, as it was supposed, the effects of his excess. In the morning he was found to be dead, and inquiry showed that the "drunkeness" was simply coal gas poisoning. It was frosty weather at the time, and the unfortunate young man had been following a practice then not uncommon, but long since disregarded, of blowing down the lamp-cocks on the public lamps to remove obstructions. This unfortunate mistake created a great impression at the time, as the victim was steady and respectable, and certainly not of the class who occasionally receive a night's accommodation at the police station, and I am told that a standing order was issued to the police, that in future, before consigning a supposed drunkard to solitary confinment, they were to notice the prisoner's breath, and take other measures for distinguishing between an overdose of alcohol and genuine poisoning or illness.

Considering the quantity of gas used in England, and the number of men employed in connection therewith, accidents of this kind are extremely uncommon. We rarely hear of anything in the way of suffocation happening to gas employees, and cases of suicide or inadvertence in the matter of shutting off the gas tap at bed time are unknown here. If fatal accidents happen at all, they are caused by the fracture of a main outside, and the consequent admission of large volumes of gas into the basement of the house. Speaking personally, after nearly 30 years uninterrupted engagement in gas manufacture and supply, I have never seen anyone seriously or alarmingly ill from coal gas poisoning. As we deal only with coal gas, containing usually about 4 or 5, and never more than 7 per cent. of carbonic oxide, the pernicious effects are not so sudden, and the person concerned is usually able to stagger away or be removed by his mates before actual unconsciousness occurs. The usual plan is to walk the sufferer about in the open air, and to administer brandy freely; and he is usually able to resume work, but suffers from headache or nausea for a day or two. A veteran gas engineer of large experience was writing to the *Journal of Gas Lighting* on this subject a week or two since, and stated that "he did not think there was even a remote possibility of loss of life if immediate attention be given, but if a man was left to lie horizontally, or taken to a hospital on a stretcher, the chances were all the other way."

This gentleman's views as to proper treatment are expressad with characteristic terseness, as follows: "Have him out, place him vertically against a wall, punch him about the body, and when he recovers give him a glass of brandy;" and this procedure is claimed to be successful without exception. If it is necessary on emergency to send a man into an atmosphere charged with coal gas, it is usual to tie a rope round his waist, and either engage him in conversation or keep him jerking at the rope. If no reply is received, or the jerking stops, he is pulled out as promptly as possible. I am not competent to argue as to the reason for administering brandy in such cases, but possibly it is simply because we English believe in brandy almost as a panacea. If a man is ill in the streets, somebody gets him some brandy at once.

A considerable amount of information has lately been forthcoming as to the causes of the explosions in electric lighting junction boxes, or transformer chambers, that have lately been so prevalent in London and elsewhere. A humorist once commenced a story thus: "A small boy, a match and a packet of gunpowder," and in a similar way the electricians have sought to dispose of these accidents by "an electric current, a short circuit and a leaky gas pipe." It is remarkable that the Government Inspectors have always ignored this suggestive attitude, and have not recognized or made any official communication with gas companies on the matter.

First we have an authoritative pronouncement from the Government on the subject. It appears that Major Cardew, the electrical adviser to the Board of Trade, while investigating the cause of explosions in St. Pancras district (London), has found a certain curious deposit upon several of the insulators which carry the electrical lines in the conduits. On examination this deposit showed the presence of pure sodium in "considerable quantity." Now, sodium, as is well known, is one of those metals that have such a strong affinity for exygen that they will decompose cold water. The affinity is stronger than that of hydrogen, and if sodium is brought into contact with water, it seizes upon its equivalent of oxygen, and the displaced hydrogen is set free as gas. Under favorable circumstances the fragment of sodium becomes brilliantly incandescent. So we may substitute sodium deposit for the leaky gas pipe, as it may be the source of a gas more strongly explosive when diluted with air than coal gas. It is evident that the electric system not only provides the match, but the gunpowder as well.

The Board of Trade attach much importance to this discovery. Not only have they taken energetic steps for further investigation with the least possible delay, but have officially addressed the electric lighting committee of St. Pancras on the matter, strongly urging that the conduits and street boxes shall be efficiently ventilated, that the spaces in which gas can accumulate shall be closed up as far as possible, and that the whole system shall be thoroughly inspected with a view to the removal of the deposit. And they hope to communicate further as to the means to be adopted for preventing such formation. The metal sodium is rare and costly, so here is a chance for another *furore* similar to that which has been made over acetylene.

A certain Mr. A. Sheppey has another theory to advance. Writing on this subject, he observes that in addition to accidents caused by faulty apparatus or careless operators, there are a number due to causes which as yet remain undiscovered, and he believes that these are to be attributed to the effects of flashes of lightning carried to earth by lightning conductors. He says that the conductor need not necessarily be close to some point in the line of conduit or cable, in order to cause an explosion. For the waves of electricity originated by atmospheric lightning have been known to travel underground for miles, not being dispersed until they reach water or damp earth. This is rather disquieting news for electricians. It would seem that the electric distributing systems are like ships anchored in an iceberg region and open to the attack of any mass that may drift towards them. Mr. Sheppey has some hopes of devising a plan that will prevent wandering lightning flashes from injuring electric wires. Perhaps he will induce them to turn down another street, or leave them a free and uninterrupted course for their journey towards the goal of water or damp earth.

A third suggestion, like the first, has the advantage of being the outcome of practical observation. Mr. A. Colson, who occupies the important position of gas and electric lighting engineer to the Corporation of Leicester, has submitted an official report to his authorities, relative to an explosion that occurred in one of the street transformer chambers under his charge, on the 13th ult. He made a careful examination of the apparatus directly after the accident, and ascribes the cause to the formation of an arc between the terminals in the high tension junction box, and the consequent gasifying of the oil used as an insulating medium. He is confident that coal gas was not concerned in the matter. His Committee have therefore decided to use a specially prepared wax in place of the oil at present in use in the transformer chambers. After this it is possible that electricians may acquit coal gas of participation in their misdeeds. At any rate, it is interesting to note that two high and independent authorities, working upon actual practical observations, have found that the electrical system has by itself provided all the factors for the explosions.

One of the advantages (?) of serving a local authority in the position of gas works manager is the free and full discussion of the emoluments and the duties that appears in the local press reports of Council meetings. At an important town in the north of England, while discussing a proposed raise of salary to the gas engineer, one Councillor asserted that the principal results of the present management had been big gas bills, bad gas, increase of price, loss of customers and small profits, at the same time "disclaiming any intention to reflect on the gas engineer." At another town, discussing a similar proposition, a Councillor stated that gas making was simply the distillation of coal, and that a man needed no professional education to be a gas engineer. In both cases the cause of offense was that the official in question, after managing his undertaking with conspicuous success, not only increasing the business, but carrying out important extensions under his own design and superintendence, had the temerity to look for some recognition of his exertions, in the shape of a raise of salary. I could go on to give numbers of such examples, showing that the Corporation officer must not be too thin-skinned. He must remember that his Committee have their seats to look after, and be willing, when thought desirable, to be immolated on the altar of popular opinion, or to be made a victim of the vote catchers. He must remember that he in his own person represents only one vote, while his stokers and laborers poll some hundreds.

The Market for Gas Securities.

The market for city shares was dull and strong during the week, the transactions being limited in Consolidated; the maximum price for a sale was 133½, at which figure only five shares changed hands. We have full belief that the stock will shortly experience a decided upward move. Standard preferred shows a constant upward tendency. We note a sale this week at auction of 10 shares, at 91½. Mutual is strong, at 155 bid, and Equitable is offered at 190. New York and East River common is weaker, the bid price being returned at 21½. We doubt, though, if any round lot of the stock could be obtained at less than 23. Madden's bill to oblige the New York and East River Company to sell gas at $1.25 per 1,000 in its district on Long Island is in the Governor's hands, and his course in relation thereto will be watched with interest. The Brooklyn situation shows no change on the surface, quotations of last week being virtually repeated. Wray's bill to prevent consolidation in Brooklyn it is said would be favorably reported to the House to-day—Friday. Chicago took a spurt to-day. The noon figure was 73, which rather goes to show that the shares are returning to the normal. Bay State common is "up" to 16 and 16½, but the incomes are "down" to 19–22. We note a sale at auction of 100 shares Indianapolis gas, at 145½. Lacledes are steady, and the outlook for better prices in common, preferred and bonds is undeniable.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

March 25.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	132⅛	133¼
Central	500,000	50	140	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	182	..
Bonds, 6's	1,000,000	..	107	..
" 1st Con. 5's	2,300,000	..	..	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	155	..
" Bonds	1,500,000	..	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50	..	..
" Bonds	150,000	..	93	98
New York and East River	5,000,000	100	21½	..
Preferred	2,000,000	100	40	45
Bonds	3,500,000	1,000	83	85
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	..	..	..
Standard	5,000,000	100	38½	41⅛
Preferred	5,000,000	100	91	..
Bonds, 1st Mortgage, 5's	1,500,000	..	102½	105
Yonkers	.....	50	112	..
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	320,000	1,000	..	101
Equity	2,000,000	100	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	103	..
Peoples	1,000,000	10	90	..
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	200	..
" Ctfs.	700,000	1,000	99	100
Williamsburgh	1,000,000	50	200	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	15	16	16½
" Income Bonds	2,000,000	1,000	19	22
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	73	74
2d " " "	3,000,000	1,000	46	47
Buffalo Mutual	750,000	100	120	..
" Bonds	200,000	1,000	95	100
Chicago Gas Co.	25,000,000	1,000	71⅛	71¼
Chicago Gas Lt. & Coke Co.				
Guaranteed Gold Bonds.	7,650,000	1,000	98	98½
Columbus	1,000,000	..	..	..
1st Mortgage	1,085,000	..	..	..
Consumers. Jersey City	2,000,000	100	72	77
" Bonds	600,000	1,000	95	100
Cincinnati G. & C. Co.	7,000,000	100	..	303¾
Consumers, Toronto	1,000,000	50	184½	187
Central, San Francisco	.....	..	90	100
Capital, Sacramento	.....	..	..	50
Consolidated, Baltimore	11,000,000	100	..	63⅝
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	18	..
" Con. Bonds	4,312,000	..	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	74	75
" Bonds	2,000,000	..	81	82
Hartford, Bonds	750,000	25	120	128
Indianapolis	2,000,000	..	145	150
" Bonds, 6's	2,650,000	..	103	..
Jersey City	750,000	20	190	200
Lafayette Gas Co., Ind.	1,000,000	100	87	..
Bonds	1,000,000	1,000	90	..
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	26	26¼
Preferred	2,500,000	100	82	85
Bonds	9,084,400	1,000	92⅛	..
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	208
New Haven	.....	25	200	..
Oakland, Cal.	.....	..	42⅝	43
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	167	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	81	..
Bonds, 6's	.....	..	..	..
Consolidated 5's	.....	..	..	..
Syracuse, N. Y.	500,000	25	..	..
San Francisco, Cal.	10,000,000	100	79⅝	79¾
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	.....	100	44½	46½
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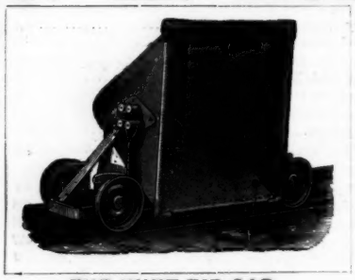

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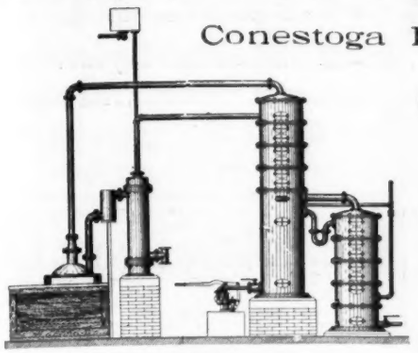

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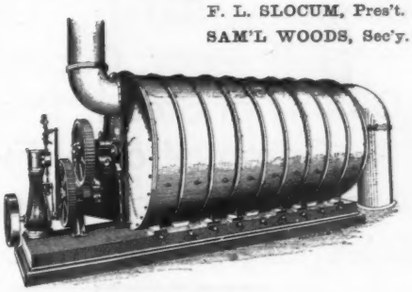

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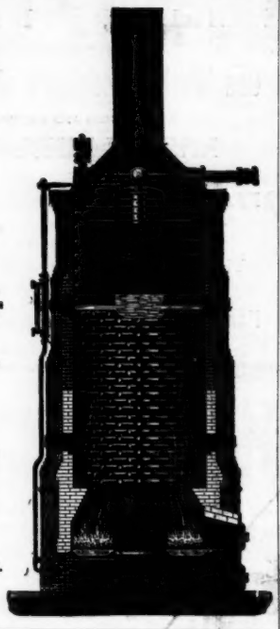

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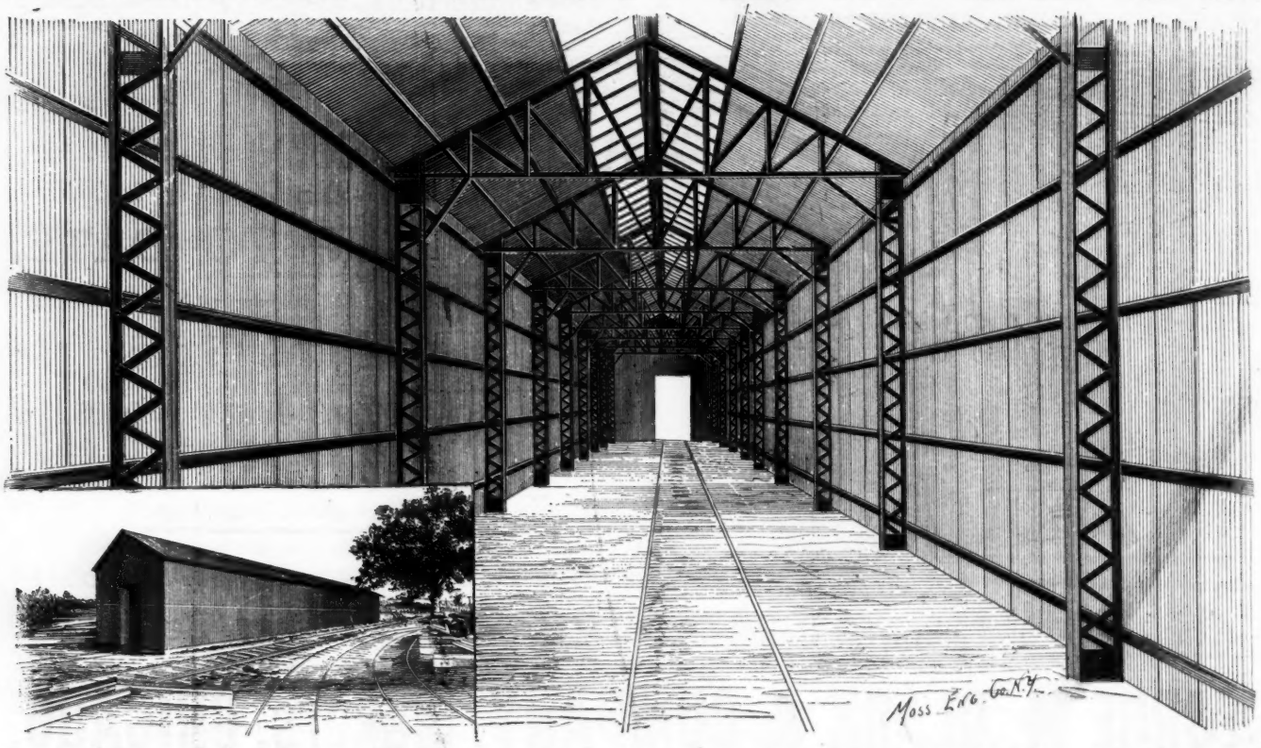

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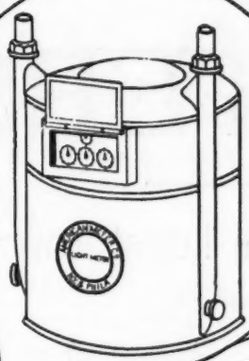

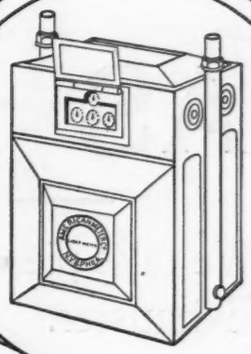

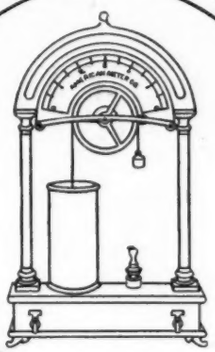

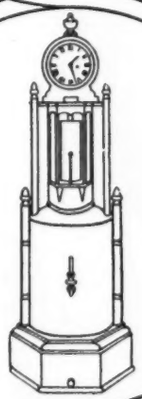

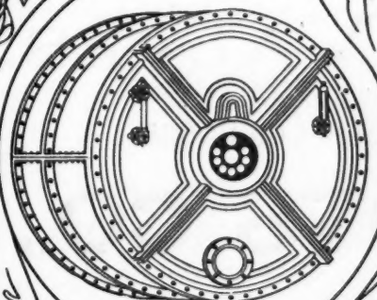

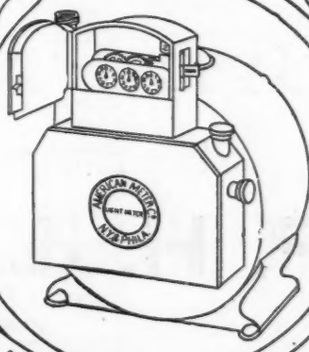

PUBLIC LIGHTING TABLE.

APRIL, 1895.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Mon.	1	12 30 AM	4.40 AM	6.10	4.55
Tue.	2	1.20 FQ	4.40	6.15	4.40
Wed.	3	2.00	4.40	6.15	4.40
Thu.	4	2.40	4.40	6.15	4.40
Fri.	5	3.00	4.40	6.15	4.40
Sat.	6	3.30	4.40	6.15	4.40
Sun.	7	4.00	4.40	6.15	4.40
Mon.	8	No L.	No L.	6.15	4.40
Tue.	9	No L. FM	No L.	6.25	4.30
Wed.	10	No L.	No L.	6.25	4.30
Thu.	11	7.00 PM	10.30 PM	6.25	4.30
Fri.	12	7.00	11.40	6.25	4.30
Sat.	13	7.00	12.40 AM	6.25	4.30
Sun.	14	7.10	1.40	6.25	4.30
Mon.	15	7.10	2.20	6.25	4.30
Tue.	16	7.10 LQ	3.00	6.30	4.20
Wed.	17	7.10	3.30	6.30	4.20
Thu.	18	7.10	4.00	6.30	4.20
Fri.	19	7.10	4.10	6.30	4.20
Sat.	20	7.10	4.10	6.30	4.20
Sun.	21	7.20	4.10	6.30	4.20
Mon.	22	7.20	4.10	6.30	4.20
Tue.	23	7.20	4.10	6.40	4.10
Wed.	24	7.20 NM	4.10	6.40	4.10
Thu.	25	7.20	4.10	6.40	4.10
Fri.	26	7.20	4.10	6.40	4.10
Sat.	27	7.20	4.10	6.40	4.10
Sun.	28	7.20	4.00	6.40	4.10
Mon.	29	11.10	4.00	6.40	4.10
Tue.	30	12.00	4.00	6.45	4.00

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146 30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

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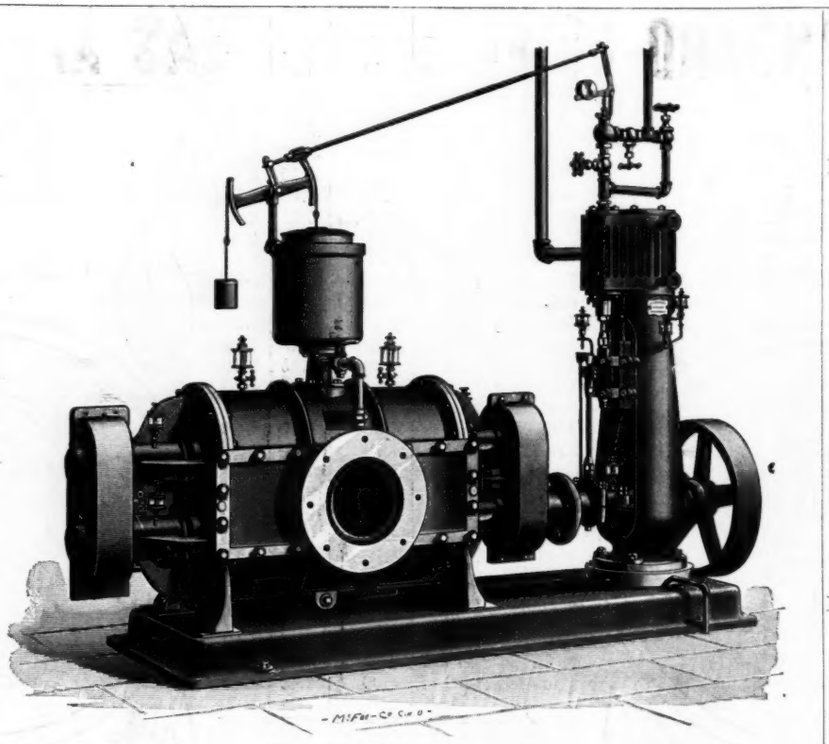

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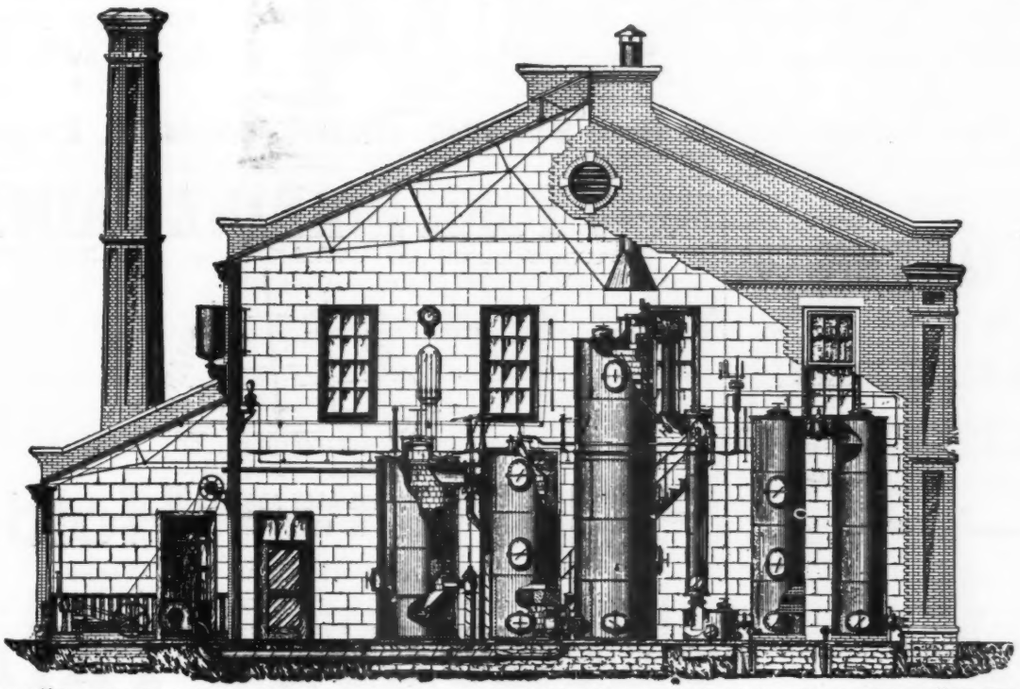

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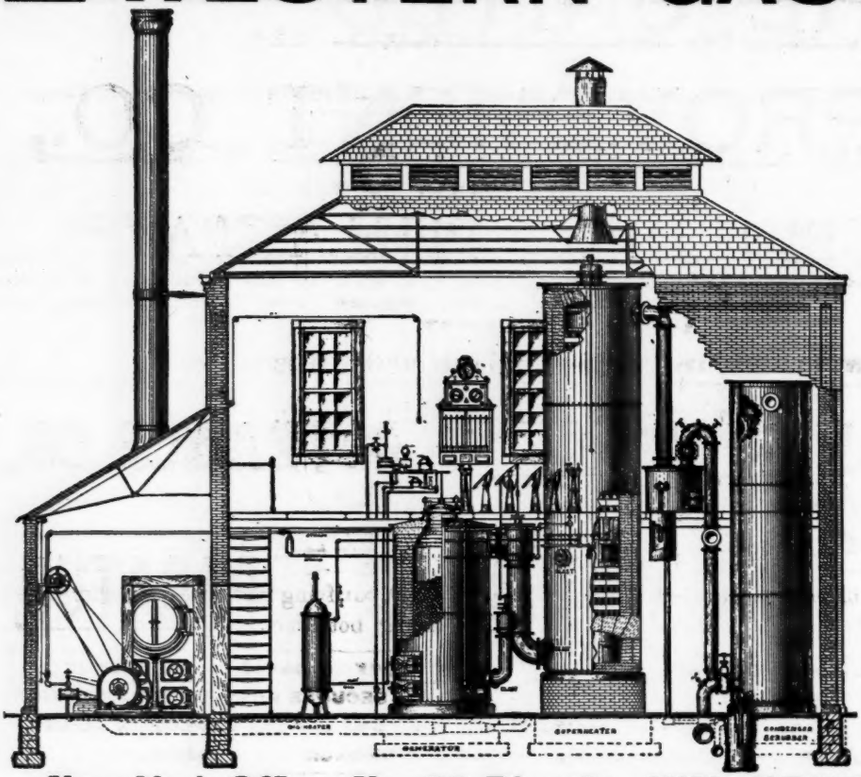

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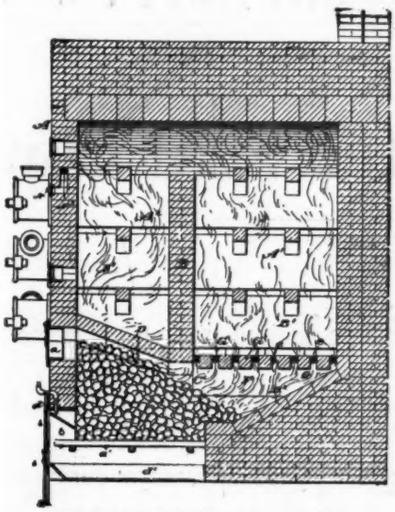

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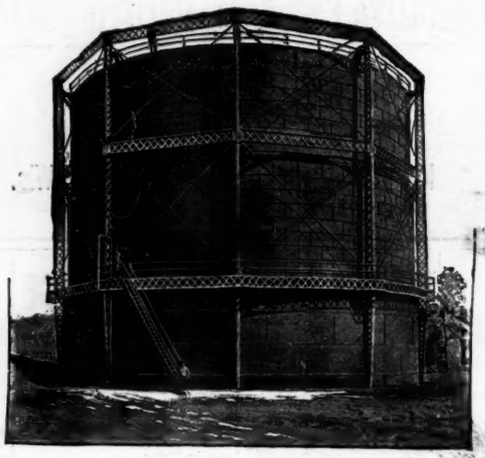

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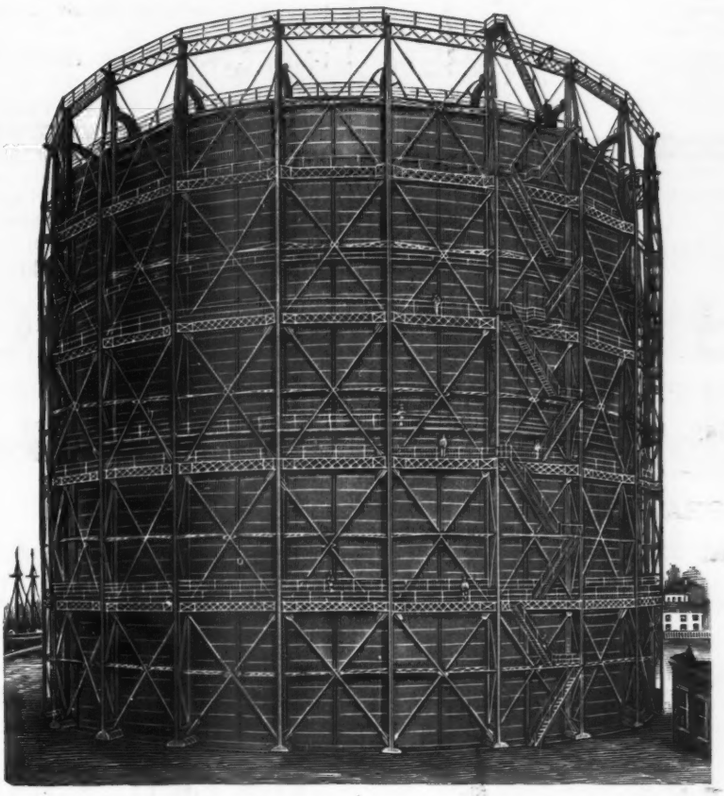

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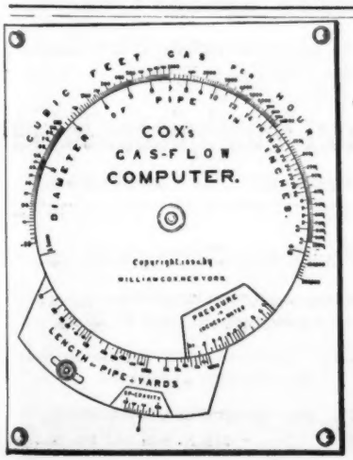

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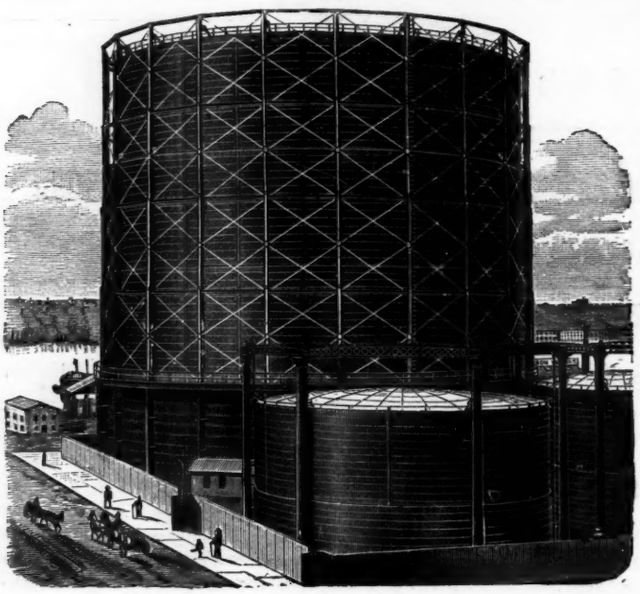

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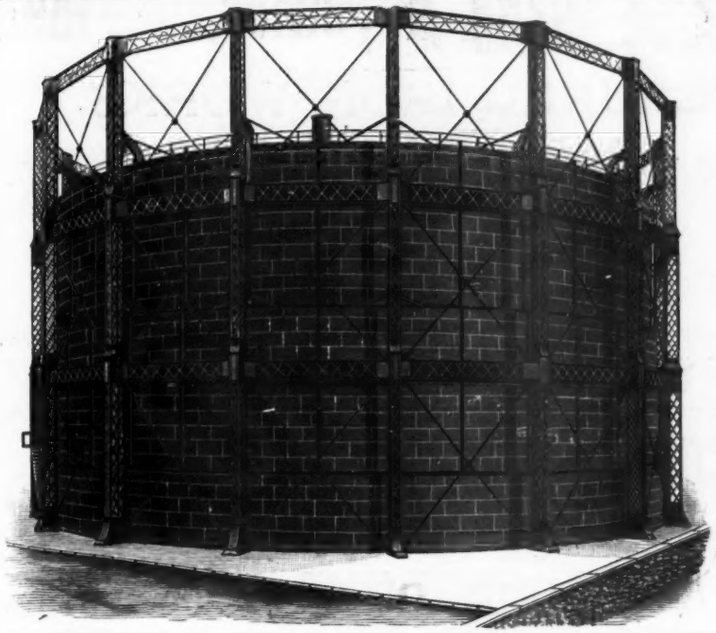

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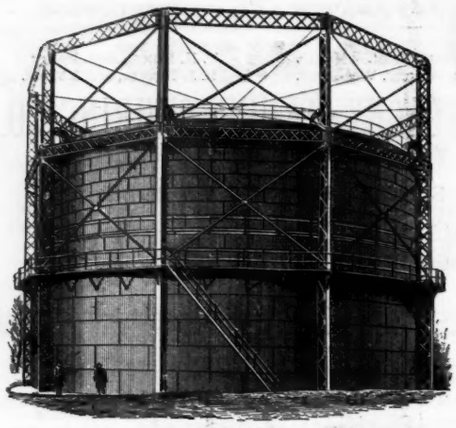

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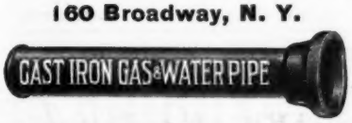

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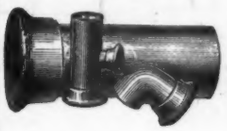

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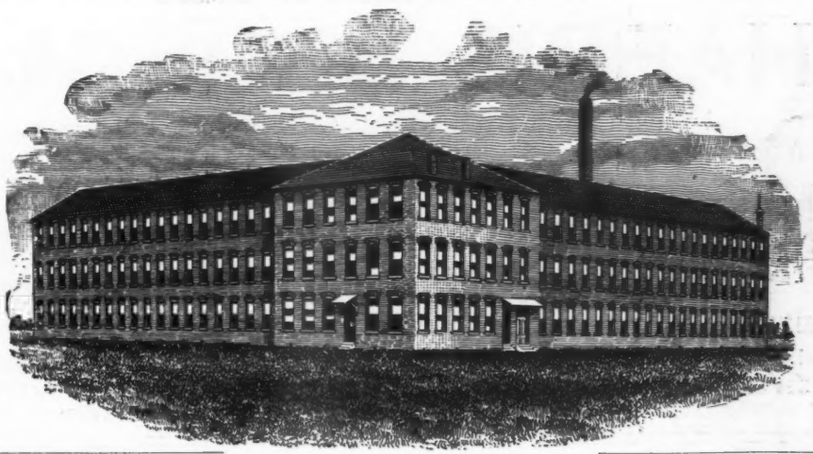

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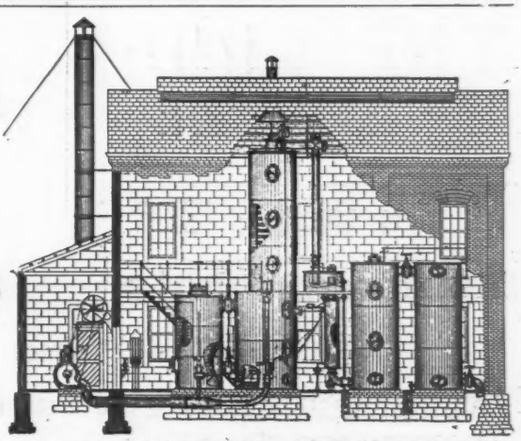

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